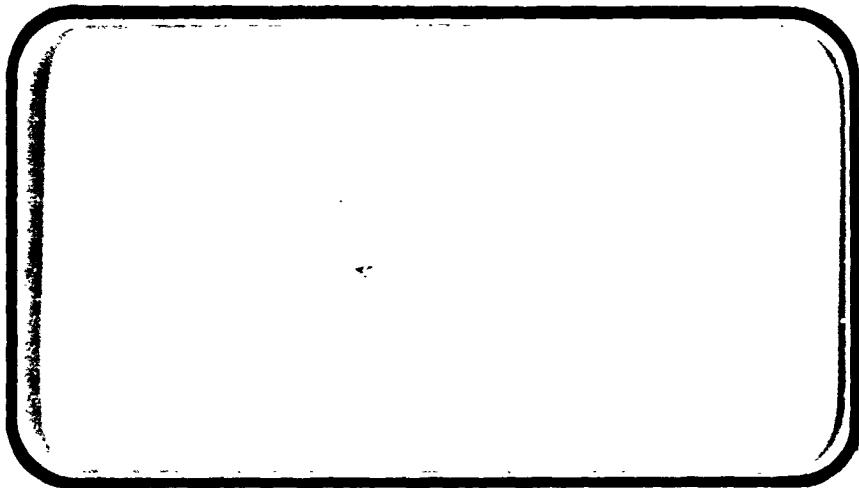


NASA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION



(NASA-CR-128787) STABILITY AND CONTROL
CHARACTERISTICS OF A Langley CONCEPT
SPACE SHUTTLE ORBITER (LO-100) AT LOW
SUBSONIC SPEEDS (Chrysler Corp.) 58 p
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23345



SPACE SHUTTLE

AEROTHERMODYNAMIC DATA REPORT

JOHNSON SPACE CENTER

HOUSTON, TEXAS

DATA MANAGEMENT services

SPACE DIVISION  CHRYSLER
CORPORATION

October, 1973

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STABILITY AND CONTROL CHARACTERISTICS
OF A LANGLEY CONCEPT SPACE SHUTTLE ORBITER (LO-100)
AT LOW SUBSONIC SPEEDS

By

Bernard Spencer, Jr., NASA/LaRC

Prepared under NASA Contract Number NAS9-13247

by

Data Management Services
Chrysler Corporation Space Division
New Orleans, La. 70189

for

Engineering Analysis Division

Johnson Space Center
National Aeronautics and Space Administration
Houston, Texas

WIND TUNNEL TEST SPECIFICS:

Test Number: LaRC LTPT 141
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data presented herein other than its display characteristics.

STABILITY AND CONTROL CHARACTERISTICS OF A
LANGLEY CONCEPT SPACE SHUTTLE ORBITER
(LO-100) AT LOW SUBSONIC SPEEDS

By

Bernard Spencer, Jr.*

SUMMARY

An experimental aerodynamic investigation was conducted on a 0.01 scale model of a Langley concept space shuttle orbiter (LO-100) in the Langley Low Turbulence Pressure Tunnel at a Mach number of 0.25 and at a Reynolds number of 5.4×10^6 per foot. The angle of attack was varied from about -2° to 24° at 0° and 5° sideslip.

The configuration was tested at elevon settings of 0° , -5° , -10° , and -15° for a body base flap setting of 0° and at 0° , -10° , and -15° for a body base flap setting of -18° . The effect of rudder flare angle was obtained using 0° , 20° , and 40° flare settings.

*NASA/LaRC

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TABLE OF CONTENTS

	<u>PAGE</u>
SUMMARY	iii
INDEX OF MODEL FIGURES	2
INDEX OF DATA FIGURES	3
NOMENCLATURE	4
DESIGN PHILOSOPHY	7
CONFIGURATIONS INVESTIGATED	8
TEST FACILITY DESCRIPTION	9
TEST CONDITIONS	9
DATA REDUCTION	10
REFERENCES	11
TABLES	
I TEST CANS	12
II DATA SET/RUN NUMBER COLLATION SUMMARY	13
III DIMENSIONAL DATA	14
FIGURES	
MODEL	20
DATA	21
APPENDIX - TABULATED SOURCE DATA	

INDEX OF MODEL FIGURES

<u>Figure</u>	<u>Description</u>	<u>Page</u>
1	Axis Systems	19
2	General Arrangement of LO-100 Orbiter	20

INDEX OF DATA FIGURES

<u>TITLE</u>	<u>PLOTTED COEFFICIENTS SCHEDULE</u>	<u>CONDITIONS VARYING</u>	<u>PAGE</u>
Elevon Effectiveness (Rudder Flare = 0.0 Degrees)	(A)	ELEVTR BDFLAP	1-6
Elevon Effectiveness (Rudder Flare = 20.0 Degrees)	(A)	ELEVTR	7-12
Effect of Rudder Flare (Elevator = 0.0 Degrees)	(A)	RUDFLR BDFLAP	13-18
Lateral - Directional Stability Characteristics	(B)	RUDFLR BETA	19-20

PLOTTED COEFFICIENTS SCHEDULE

(A) CA, CPB, CPC1, CPC2, CN versus ALPHA

CN versus CLM
CL versus ALPHA
CL versus CLM
CLM, L/D, CD versus ALPHA
CD versus CL

(B) DCY/DB, DCYNDB, DCBLDB versus ALPHA
CY, CYN, CBL versus ALPHA

NOMENCLATURE
General

<u>SYMBOL</u>	<u>SADSAC SYMBOL</u>	<u>DEFINITION</u>
a		speed of sound; m/sec, ft/sec
C_p	CP	pressure coefficient; $(p_1 - p_\infty)/q$
M	MACH	Mach number; V/a
p		pressure; N/m^2 , psf
q	$Q(NSM)$ $Q(PSF)$	dynamic pressure; $1/2\rho V^2$, N/m^2 , psf
RN/L	RN/L	unit Reynolds number; per m, per ft
V		velocity; m/sec, ft/sec
α	ALPHA	angle of attack, degrees
β	BETA	angle of sideslip, degrees
ψ	PSI	angle of yaw, degrees
ϕ	PHI	angle of roll, degrees
ρ		mass density; kg/m^3 , slugs/ ft^3

Reference & C.G. Definitions

A_b	base area; m^2 , ft^2
b	wing span or reference span; m, ft
c.g.	center of gravity
l_{REF}	reference length or wing mean aerodynamic chord; m, ft
S	wing area or reference area; m^2 , ft^2
MRP	moment reference point
XMRP	moment reference point on X axis
YMRP	moment reference point on Y axis
ZMRP	moment reference point on Z axis

SUBSCRIPTS

b	base
l	local
s	static conditions
t	total conditions
∞	free stream

NOMENCLATURE (Continued)

Body-Axis System

<u>SYMBOL</u>	<u>SADSAC SYMBOL</u>	<u>DEFINITION</u>
C_N	CN	normal-force coefficient; $\frac{\text{normal force}}{qS}$
C_A	CA	axial-force coefficient; $\frac{\text{axial force}}{qS}$
C_Y	CY	side-force coefficient; $\frac{\text{side force}}{qS}$
C_{A_b}	CAB	base-force coefficient; $\frac{\text{base force}}{qS}$ $-A_b(p_b - p_\infty)/qS$
C_{A_f}	CAF	forebody axial force coefficient, $C_A - C_{A_b}$
C_m	CLM	pitching-moment coefficient; $\frac{\text{pitching moment}}{qS_{\text{REF}}}$
C_n	CYN	yawing-moment coefficient; $\frac{\text{yawing moment}}{qS_b}$
C_l	CBL	rolling-moment coefficient; $\frac{\text{rolling moment}}{qS_b}$
<u>Stability-Axis System</u>		
C_L	CL	lift coefficient; $\frac{\text{lift}}{qS}$
C_D	CD	drag coefficient; $\frac{\text{drag}}{qS}$
C_{D_b}	CDB	base-drag coefficient; $\frac{\text{base drag}}{qS}$
C_{D_f}	CDF	forebody drag coefficient; $C_D - C_{D_b}$
C_Y	CY	side-force coefficient; $\frac{\text{side force}}{qS}$
C_m	CLM	pitching-moment coefficient; $\frac{\text{pitching moment}}{qS_{\text{REF}}}$
C_n	CLN	yawing-moment coefficient; $\frac{\text{yawing moment}}{qS_b}$
C_l	CSL	rolling-moment coefficient; $\frac{\text{rolling moment}}{qS_b}$
L/D	L/D	lift-to-drag ratio; C_L/C_D

NOMENCLATURE (Continued)

ADDITIONS TO STANDARD LIST

<u>SYMBOL</u>	<u>PLOT SYMBOL</u>	<u>DEFINITION</u>
C_{PB}	CPB	pressure coefficient at base
C_{PC1}	CPC1	pressure coefficient in balance cavity at location #1
C_{PC2}	CPC2	pressure coefficient in balance cavity at location #2
$C_{Y\beta}$	DCY/DB	side force coefficient derivative with respect to beta. Algebraic difference of the side force coefficient of two runs divided by the algebraic difference of the side slip angle of the runs; per degree.
$C_{n\beta}$	DCYNDB	yawing moment coefficient derivative with respect to beta. Algebraic difference of the yawing moment coefficient of two runs divided by the algebraic difference of the side slip angle of the runs; body axis system; per degree.
$C_{l\beta}$	DCBLDB	rolling moment coefficient derivative with respect to beta. Algebraic difference of the rolling moment coefficient of two runs divided by the algebraic difference of the side slip angle of the runs; body axis system; per degree.
δ_e	ELEVTR	elevator deflection, degrees; determined by: $(\delta e_L + \delta e_R)/2$
δ_a	AILRON	aileron deflection, degrees; determined by: $(\delta e_L - \delta e_R)/2$
δ_{BF}	BDFLAP	body flap deflection, degrees; positive direction trailing edge down.
δ_{RF}	RUDFLR	rudder flare, split rudder deflection angle, left split rudder trailing edge left and right split rudder trailing edge right, $\delta_{RF} = (\delta_{RL} + \delta_{RR})/2$, positive deflection; degrees.

DESIGN PHILOSOPHY

During the course of phase B activity prior to the selection of a prime contractor to develop and build the Space Shuttle, Langley Research Center undertook in-house design of several orbiter configurations which would meet mission qualifications as specified in the request-for-proposals. The objectives of these in-house efforts were to design a configuration meeting mission requirements, based on previous experience in subsonic/hypersonic spacecraft development, and gain additional knowledge in a particular design philosophy in order to better evaluate the various proposed orbiter concepts. The present paper presents aerodynamic results obtained on one conceptual design developed by Space Systems Division.

The basic mission requirements to be satisfied were maximum subsonic angle of attack for landing of 18° with a minimum landing speed of 150 knots for a recovery weight of 170,000 lbs. payload out and 210,000 payload in. Hypersonic requirements specified stable trim angle-of-attack range from about 18° to 40° encompassing conditions satisfying high-to-low cross range missions, and a maximum lift-to-drag ratio near 2.0.

The basic wing selected for the present design has 53.2° leading-edge sweep, unswept trailing edge, taper ratio of 0.15, aspect ratio of 2.212, NACA 0006 airfoil section at the theoretical root, NACA 0012 airfoil section at the tip with 1° of incidence in the root section and -4° incidence at the tip. This particular planform was selected from subsonic considerations since previous experience indicated linearity in lift-curve slope to angles of attack near 20° (ref. 1) and linearity in

pitch to high lift (ref. 2). Although wings of lesser sweep produce higher low-angle lift-curve-slope, earlier stall occurs resulting in large lift losses at the specified angle for landing (i.e. $\alpha \approx 18^\circ$) and resultantly large pitch-down which would require high control deflections for trim and additional losses in lift. Estimated trimmed lift for the present design, employing the methods of reference 3, results in a required wing area of 3471 square feet for a landing weight of 210,000 lbs. Longitudinal location of the wing is estimated to produce a 2 percent static margin at subsonic speeds and a basic stable trim angle of about 18° at hypersonic speeds for an estimated forward center of gravity 66 percent of body length.

The fuselage of the present concept has a maximum cross sectional area somewhat in excess of the minimum required to house the 15 foot diameter payload bay. This was done in order to allow for some body base秉 tailing to reduce subsonic base drag and improve aerodynamic performance. The fuselage forebody incorporates an upswept nose (positive camber) to produce near zero or positive pitch at zero angle of attack at hypersonic speeds. A body base flap is also included to shield the main engine during entry and also as a hypersonic control device. Overall body length (excluding base flap) is 1350 inches.

CONFIGURATIONS INVESTIGATED

These tests utilized a 0.01 scale model of the LaRC LO-100 orbiter. The model components tested are listed below. Pertinent dimensional information for these components is given in table III. Table II delineates

the various configurations these components were tested in during this investigation.

B - Body

E - Elevon

FB - Body Flap

V - Vertical Tail

W1 - Wing

TEST FACILITY DESCRIPTION

The tests were conducted in the Langley low turbulence pressure tunnel which is a variable-pressure, single return facility with a closed rectangular test section that is 0.914 meter (3.00 ft.) wide and 2.290 meter (7.50 ft.) high. The tunnel can accommodate tests in air at low subsonic Mach numbers and at a Reynolds number per unit length up to about 49.2×10^6 per meter (15.0×10^6 per foot).

TEST CONDITIONS

Tunnel conditions existing during the test are summarized in Table I (Test Conditions). The model was sting supported and the aerodynamic forces and moments were measured by an internally mounted six-component strain gage balance. Model angle of attack was varied from about -2° up to 24° for angles of sideslip of 0° and 5° , and corrected for the effects of sting and balance bending under load.

DATA REDUCTION

Aerodynamic forces and moments have been reduced to coefficient form based on the following reference values:

s_{REF} = wing theoretical planform area = 0.3471 ft.²

l_{REF} = fuselage length = 13.50 inches

b_{REF} = wing reference span = 10.5151 inches

Moments have been reduced about a center of gravity located at 66 percent of the fuselage length. This point is:

Fus. Sta. = 8.910 inches

Water line = 0 (centerline payload bay)

Body line = 0.0

Base pressure coefficients are presented for both the base and cavity regions. Normal tunnel blockage and lift interference effects have been applied to the data. No transition strips were used during the test. Drag data presented herein represents gross drag in that base and cavity pressures have not been adjusted to free stream conditions.

REFERENCES

1. Graham, David: The Low Speed Lift and Drag Characteristics of Airplane Models Having Triangular or Modified Triangular Wings. NACA RMA-53D14, June 15, 1953.
2. Spreemann, Kenneth P.: Design Guide for Pitch-Up Evaluation and Investigation at High Subsonic Speeds of Possible Limitations Due to Wing-Aspect-Ratio Variations. NASA TMX-26, 1959.
3. Spencer, Bernard, Jr.: A Simplified Method for Estimating Subsonic Lift Curve Slope at Low Angles of Attack for Irregular Planform Wings. NASA TMX-525, May 1961.

TABLE I.

TEST : LARC LTPT-141

DATE :

TEST CONDITIONS

BALANCE UTILIZED:

LaRC 2030

	CAPACITY:	ACCURACY:	COEFFICIENT TOLERANCE:
NF	<u>200 lb.</u>	<u>± 1.0 lb.</u>	
SF	<u>50 lb.</u>	<u>± 0.25 lb.</u>	
AF	<u>60 lb.</u>	<u>± 0.30 lb.</u>	
PM	<u>300 in.-lb.</u>	<u>± 1.50 in.-lb.</u>	
RM	<u>60 in.-lb.</u>	<u>± 0.30 in.-lb.</u>	
YM	<u>40 in.-lb.</u>	<u>± 0.20 in.-lb.</u>	

COMMENTS:

TABLE II.

DATA SET/RUN NUMBER COLLATION SUMMARY DATE : JULY/AUGUST, 1973

TABLE III.
DIMENSIONAL DATA

MODEL COMPONENT: BODY - B

GENERAL DESCRIPTION:

DRAWING NUMBER

DIMENSION:

	In. or In ²	
Length	1350	
Max Width	125.55	
Max Depth	231.0	
Fineness Ratio		
Area		
Max Cross-Sectional		
Planform		
Wetted		
Base		

TABLE III. (Continued)

MODEL COMPONENT: ELEVON

GENERAL DESCRIPTION: _____

DRAWING NUMBER: _____

<u>DIMENSIONS:</u>	<u>FULL-SCALE</u>	<u>MODEL SCALE</u>
Area	<u>48,751.2</u>	_____
Span (equivalent)	<u>399.6</u>	_____
Inb'd equivalent chord	<u>122.0</u>	_____
Outb'd equivalent chord	<u>122.0</u>	_____
Ratio moveable surface chord/ total surface chord		
At Inb'd equiv. chord	<u>-----</u>	_____
At Outb'd equiv. chord	<u>-----</u>	_____
Sweep Back Angles, degrees		
Leading Edge	<u>0°</u>	_____
Tailing Edge	<u>0°</u>	_____
Hingeline	<u>0°</u>	_____
Area Moment (Normal to hinge line)	<u>-----</u>	_____

TABLE III. (Concluded)

MODEL COMPONENT: BODY FLAP - FB

GENERAL DESCRIPTION: _____

DRAWING NUMBER: _____

<u>DIMENSIONS:</u>	<u>FULL-SCALE</u> in. or in. ²	<u>MODEL SCALE</u>
Area	<u>10,000</u>	_____
Span (equivalent)	<u>252.0</u>	_____
Inb'd equivalent chord	<u>79.65</u>	_____
Outb'd equivalent chord	<u>79.65</u>	_____
Ratio movable surface chord/ total surface chord		
At Inb'd equiv. chord	<u>---</u>	_____
At Outb'd equiv. chord	<u>---</u>	_____
Sweep Back Angles, degrees		
Leading Edge	<u>---</u>	_____
Tailing Edge	<u>---</u>	_____
Hingeline	<u>---</u>	_____
Area Moment (Normal to hinge line)	<u>---</u>	_____

TABLE III. (Continued)

MODEL COMPONENT: VERTICAL TAIL - V

GENERAL DESCRIPTION: _____

DRAWING NUMBER: _____

DIMENSIONS:TOTAL DATA

Area
 Planform
 Wetted
 Span (equivalent)
 Aspect Ratio
 Rate of Taper
 Taper Ratio
 Dihedral Angle, degrees
 Incidence Angle, degrees
 Aerodynamic Twist, degrees
 Toe-In Angle
 Cant Angle
 Sweep Back Angles, degrees
 Leading Edge
 Trailing Edge
 0.25 Element Line
 Chords:
 Root (Wing Sta. 0.0)
 Tip, (equivalent)
 MAC
 Fus. Sta. of .25 MAC
 W.P. of .25 MAC
 B.L. of .25 MAC
 Airfoil Section

FULL-SCALE
 in. or in.²

MODEL SCALE

69,836

369.2

45°

25°

288.0

90.35

NACA
 NACA

EXPOSED DATA

Area
 Span, (equivalent)
 Aspect Ratio
 Taper Ratio
 Chords
 Root
 Tip
 MAC
 Fus. Sta. of .25 MAC
 W.P. of .25 MAC
 B.L. of .25 MAC

TABLE III. (Continued)

MODEL COMPONENT: WING - S1

GENERAL DESCRIPTION: _____

DRAWING NUMBER: _____

<u>DIMENSIONS:</u>	<u>FULL-SCALE</u>	<u>MODEL SCALE</u>
	in. or in. ²	

TOTAL DATA

Area		
Planform	499,824	_____
Wetted	---	_____
Span (equivalent)	1051.512	_____
Aspect Ratio	2.212	_____
Rate of Taper	---	_____
Taper Ratio	.15	_____
Dihedral Angle, degrees	7.0°	_____
Incidence Angle, degrees	+1° root, -4° tip	_____
Aerodynamic Twist, degrees	"	_____
Toe-In Angle	---	_____
Cant Angle	---	_____
Sweep Back Angles, degrees		
Leading Edge	53.2°	_____
Trailing Edge	0.0°	_____
0.25 Element Line	---	_____
Chords:		
Root (Wing Sta. 0.0)	826.8	_____
Tip, (equivalent)	124.02	_____
MAC	561.984	_____
Fus. Sta. of .25 MAC	928.508	_____
W.P. of .25 MAC	---	_____
B.L. of .25 MAC	---	_____
Airfoil Section		
Root	NACA 0006-64	_____
Tip	NACA 0012-64	_____

EXPOSED DATA

Area		
Span, (equivalent)	_____	_____
Aspect Ratio	_____	_____
Taper Ratio	_____	_____
Chords		
Root	_____	_____
Tip	_____	_____
MAC	_____	_____
Fus. Sta. of .25 MAC	_____	_____
W.P. of .25 MAC	_____	_____
B.L. of .25 MAC	_____	_____

Notes:

1. Positive directions of force coefficients, moment coefficients, and angles are indicated by arrow
2. For clarity, origins of wind and stability axes have been displaced from the center of gravity

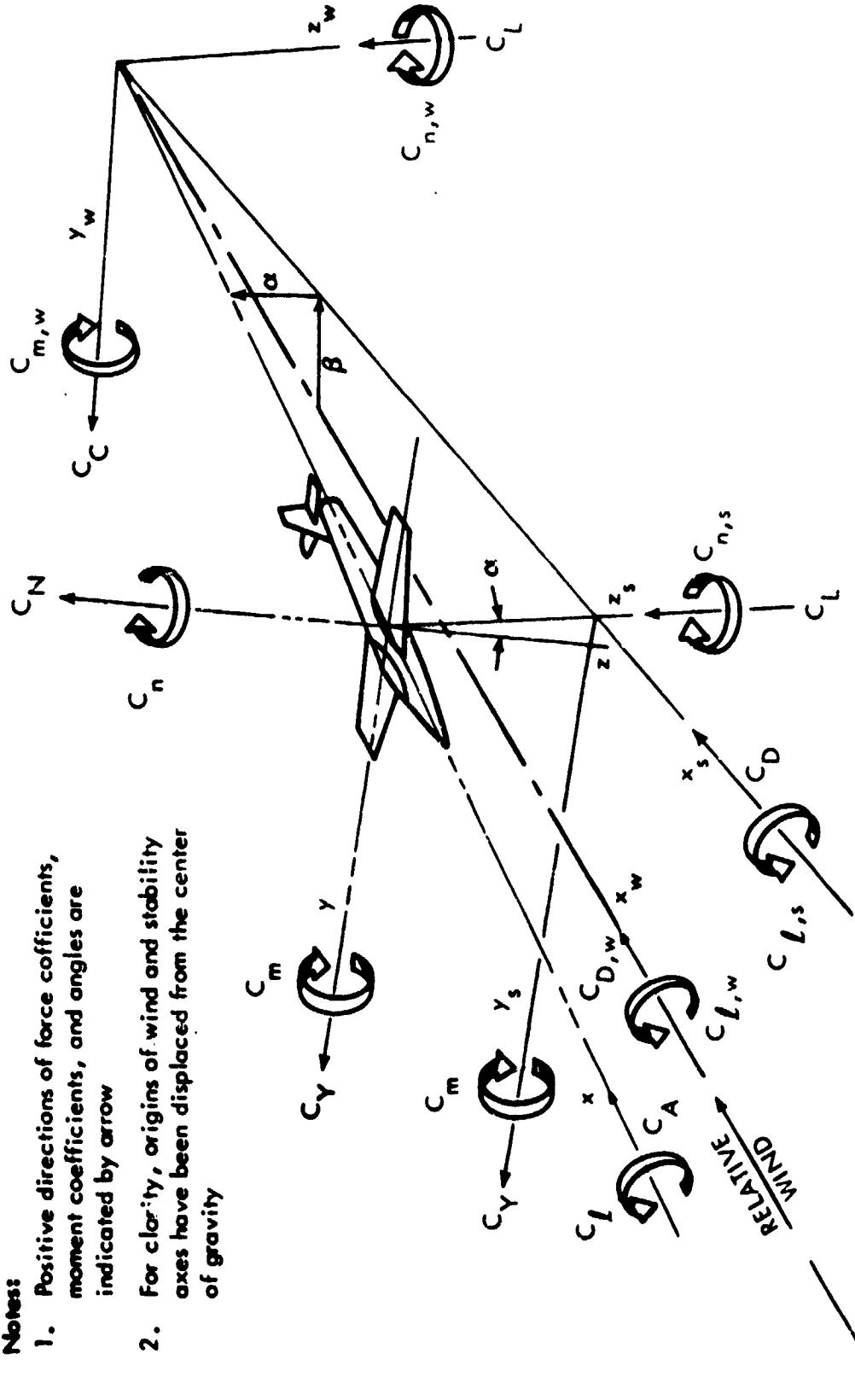


Figure 1. - Axis systems.

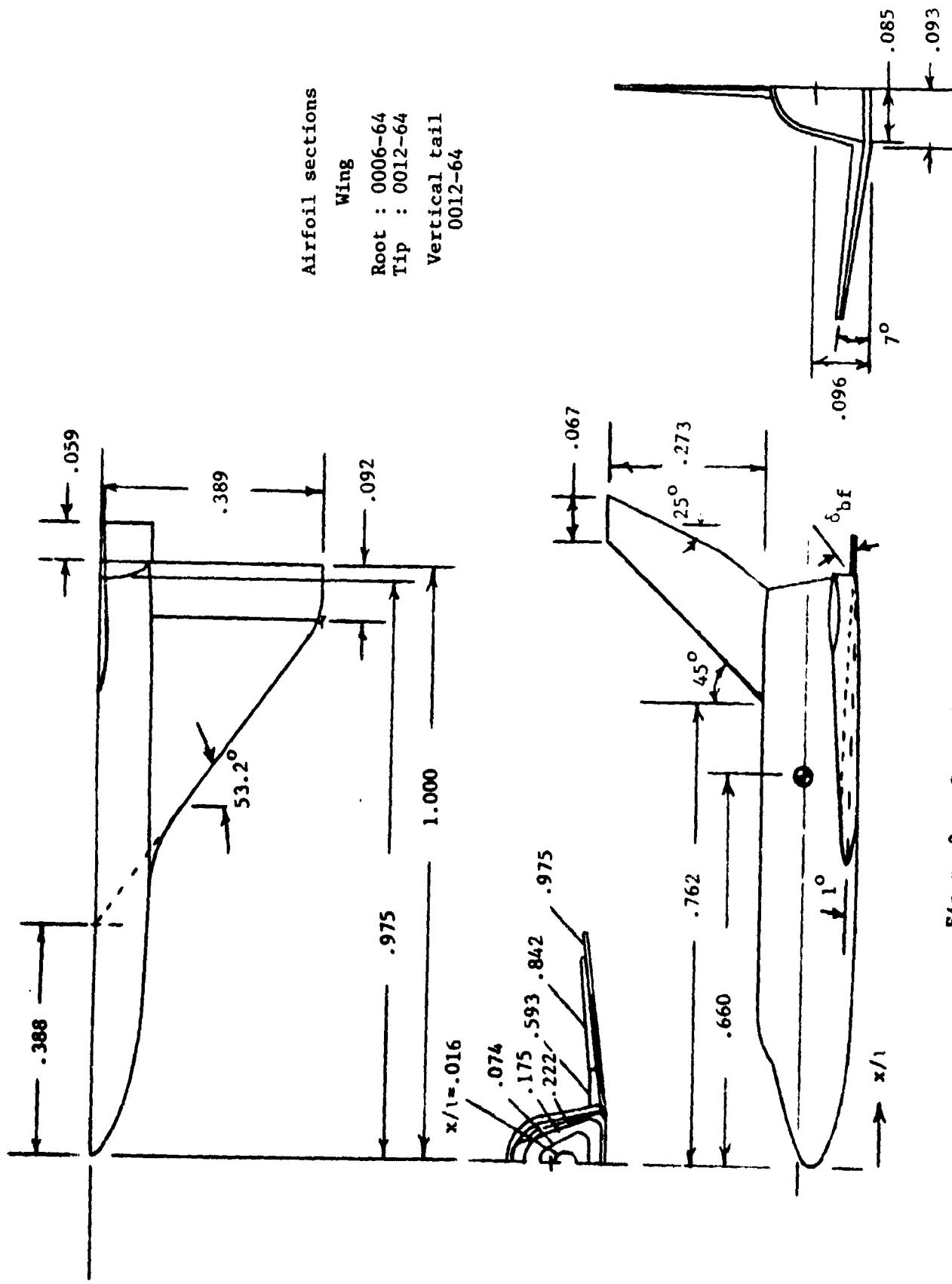
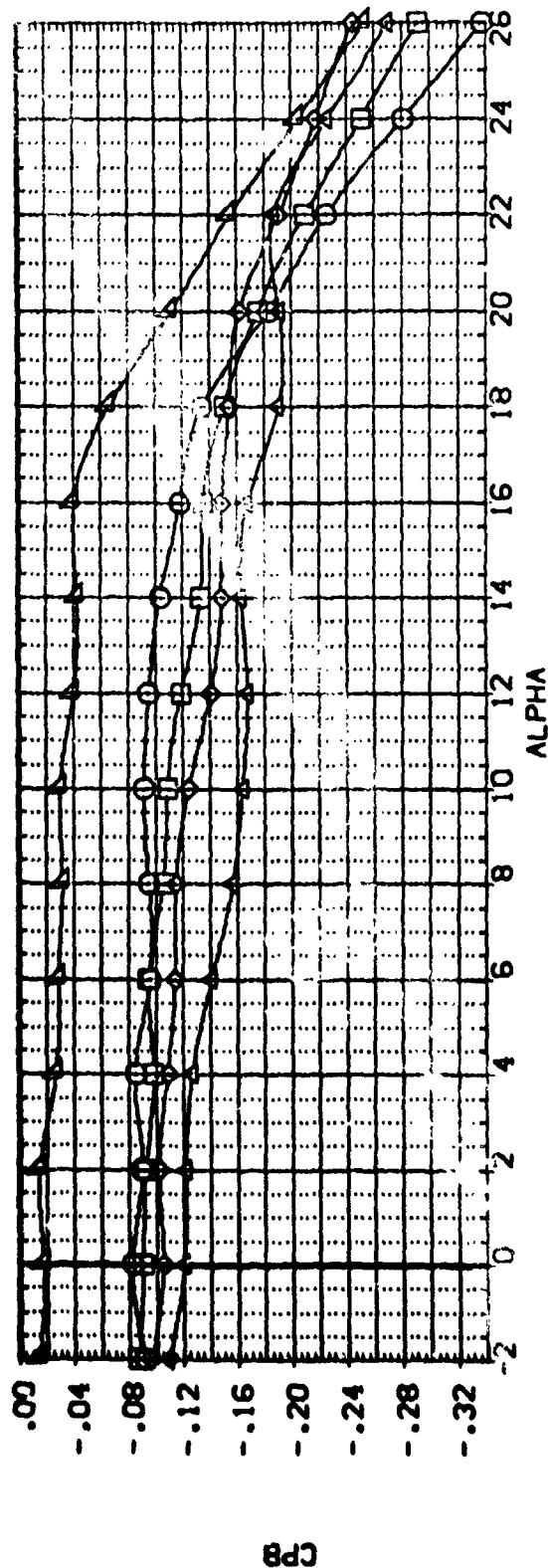
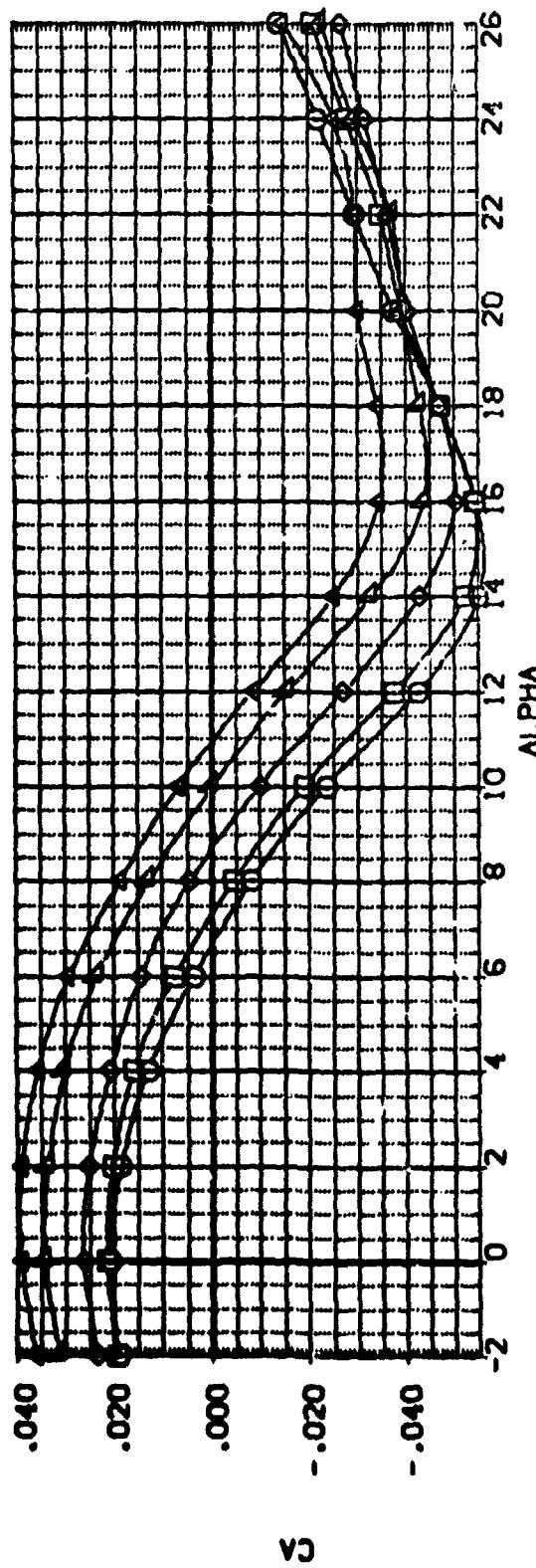


Figure 2. - General arrangement of L0-100 orbiter.

DATA FIGURES

DATA SET NUMBER	CONFIGURATION DESCRIPTION	ELEVTR	AIRDN	BDFLAP	RUDFLR	REFERENCE IN UNITS	SP. IN.
(FP001)	55-2301 TPT-141 LARC LD-100 ORBITER (5W/1W)	.000	.000	.000	.000	SP01	49.9824
(FP002)	55-2301 TPT-141 LARC LD-100 ORBITER (5W/1W)	.000	.000	.000	.000	REF	13.5000
(FP003)	55-2301 TPT-141 LARC LD-100 ORBITER (5W/1W)	.000	.000	.000	.000	REF	10.5145
(FP004)	55-2301 TPT-141 LARC LD-100 ORBITER (5W/1W)	.000	.000	.000	.000	REF	8.9150
(FP005)	55-2301 TPT-141 LARC LD-100 ORBITER (5W/1W)	.000	.000	.000	.000	YAWP	.0000
						SCALE	.0000

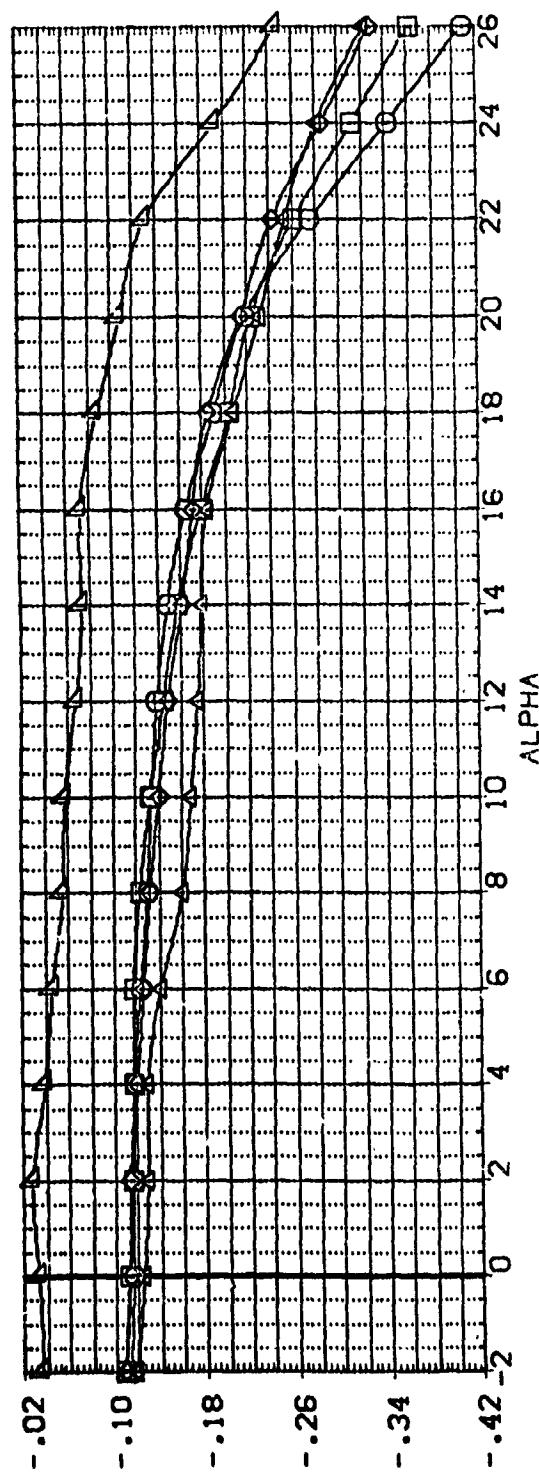


ELEVON EFFECTIVENESS (RUDDER FLARE = 0.0 DEGREES)

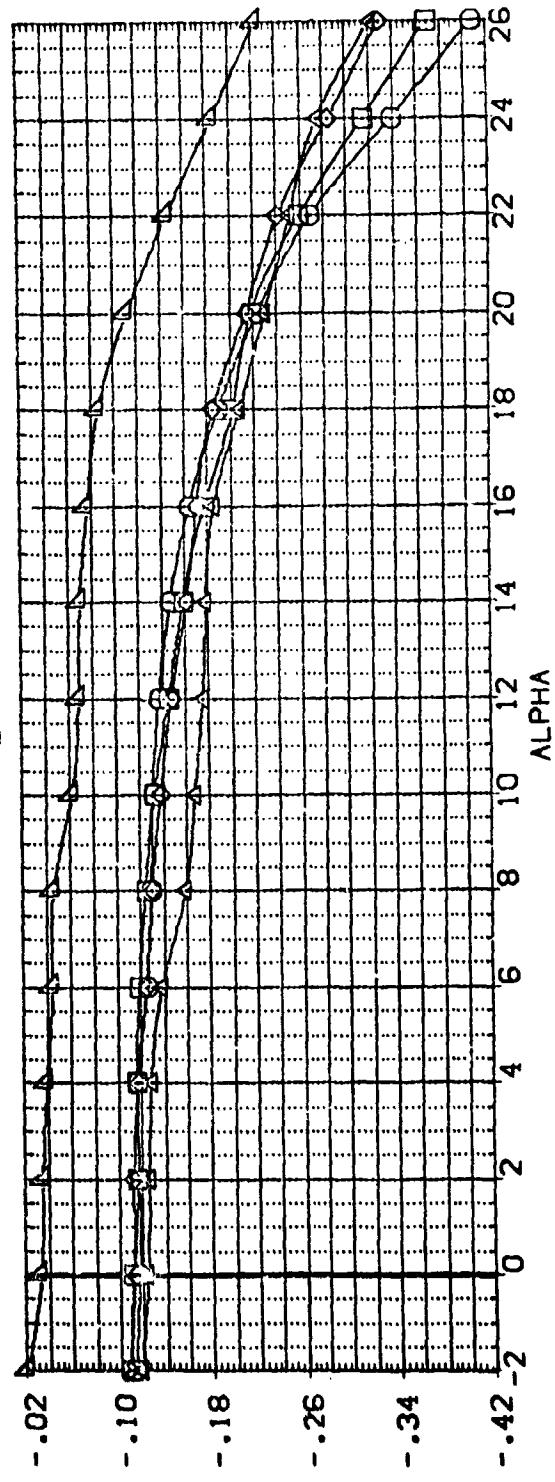
$$[\text{Ca}]_{\text{RN/L}} = 5.40$$

DATA SET SYMBOL CONFIGURATION DESCRIPTION

(FP0001)	□	LA-23(LTP)-111ARC	LO-100 ORBITER (BV/VFB)	SREF .000
(FP0002)	□	LA-23(LTP)-111ARC	LO-100 ORBITER (BV/VFB)	LREF .000
(FP0003)	□	LA-23(LTP)-111ARC	LO-100 ORBITER (BV/VFB)	BREF .000
(FP0004)	□	LA-23(LTP)-111ARC	LO-100 ORBITER (BV/VFB)	XMRP .000
(FP0005)	□	LA-23(LTP)-111ARC	LO-100 ORBITER (BV/VFB)	YMRP .000
				ZMRP .000
				SCALE .010



CPC1



CPC2

ELEVON EFFECTIVENESS (RUDDER FLARE = 0.0 DEGREES)

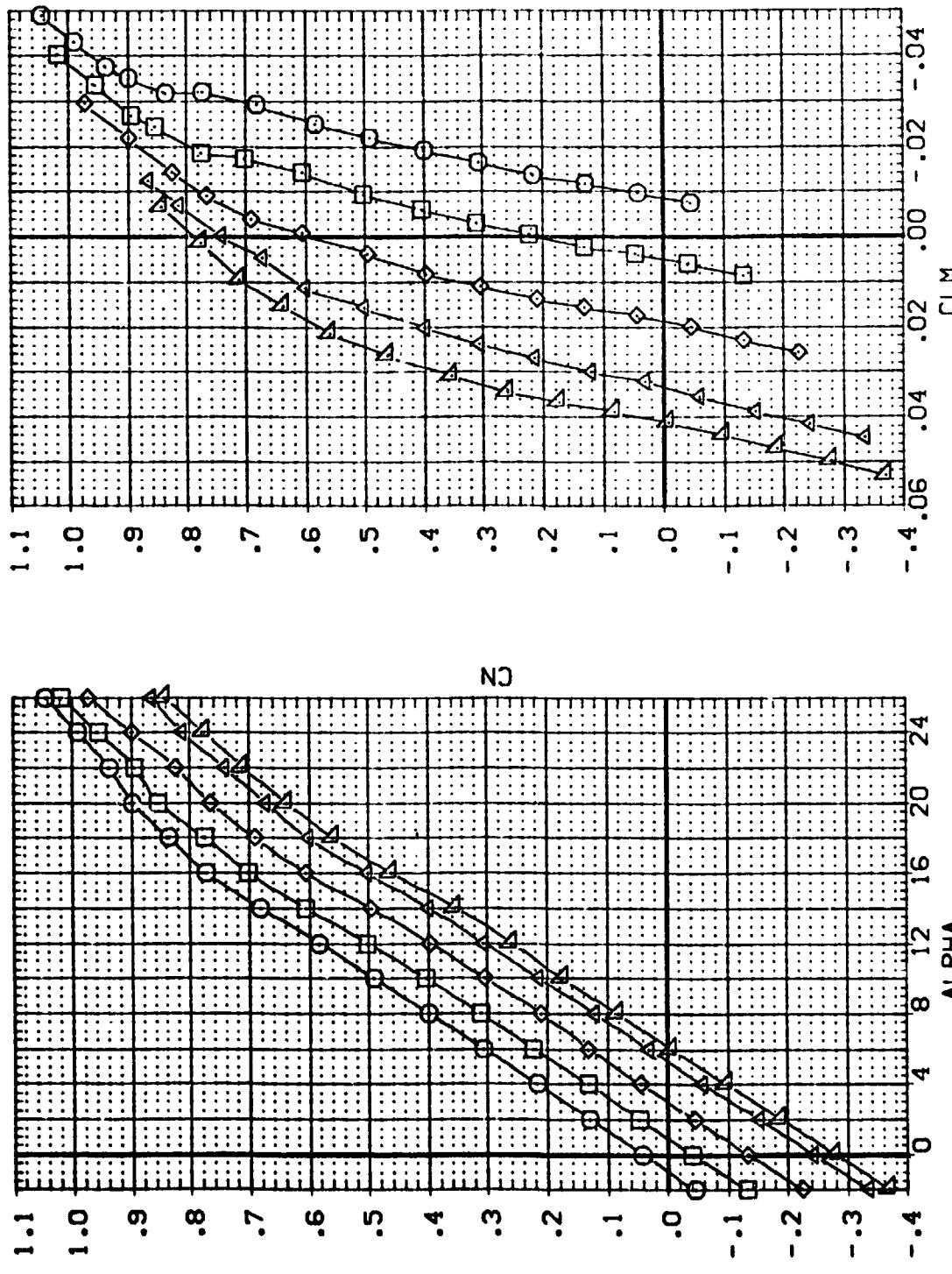
$$(\Delta)RN/L = 5.40$$

DATA SET SYMBOL CONFIGURATION DESCRIPTION

(FPJ001)	LA-23(LTP-141)ARC	LO-100	CRBLTER	(BV)WFB
(FPJ002)	LA-23(LTP-141)ARC	LO-100	CRBLTER	(BV)WFB
(FPJ003)	LA-23(LTP-141)ARC	LO-100	CRBLTER	(BV)WFB
(FPJ004)	LA-23(LTP-141)ARC	LO-100	CRBLTER	(BV)WFB
(FPJ005)	LA-23(LTP-141)ARC	LO-100	CRBLTER	(BV)WFB

REFERENCE INFORMATION

SD IN.	.49 .9824
REF INCHES	.13 .5000
BREF INCHES	.10 .5155
XMRP INCHES	.8 .9100
YMRP INCHES	.0000
ZMRP .0100	.0100
SCALE	

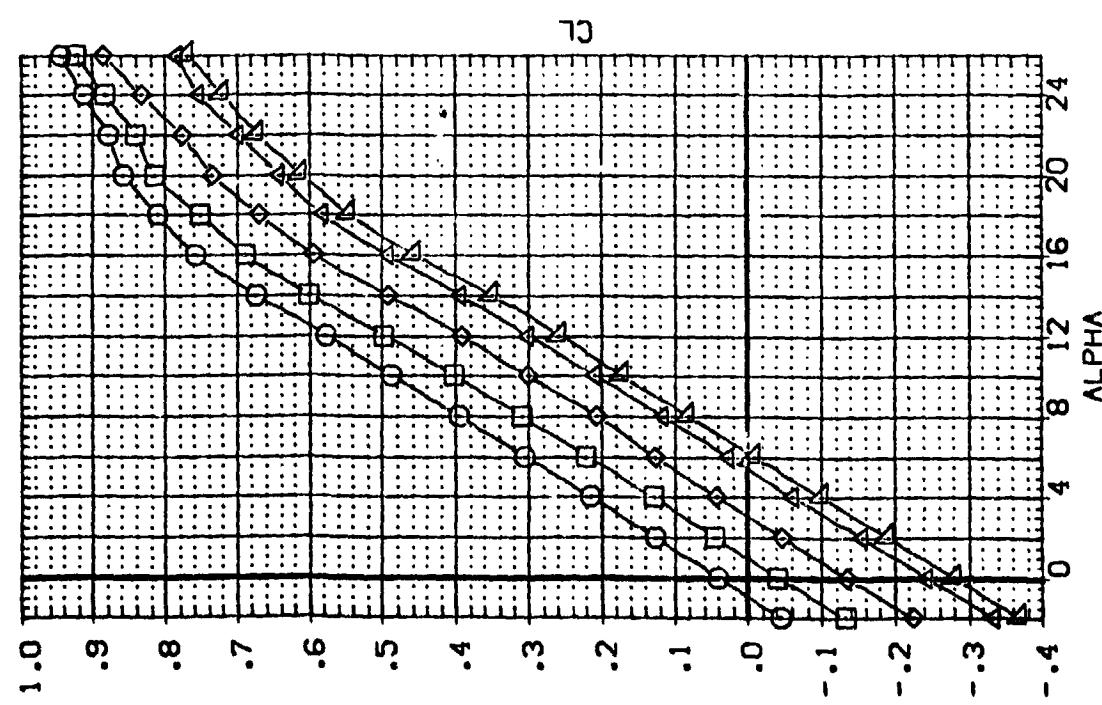


ELEVON EFFECTIVENESS (RUDDER FLARE = 0.0 DEGREES)

(A)RN/L = 5.40

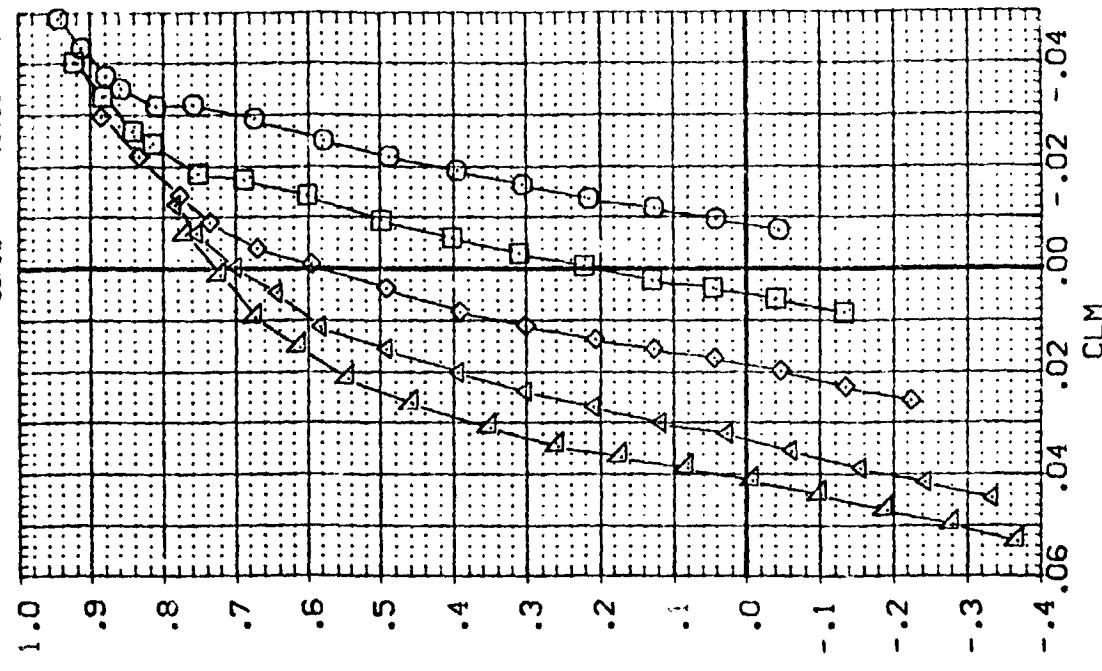
PAGE 3

		REFERENCE INFORMATION	
ELEVIR	AIRRON	RUOFLR	SC. IN.
.000	.000	.000	49. 9824
-5.000	.000	.000	13.5000
-10.000	.000	.000	10.551
-15.000	.000	.000	8.9100
-15.000	.000	.000	.000
			SCALE



ELEVON EFFECTIVENESS (RUDDER FLARE = 0.0 DEGREES)

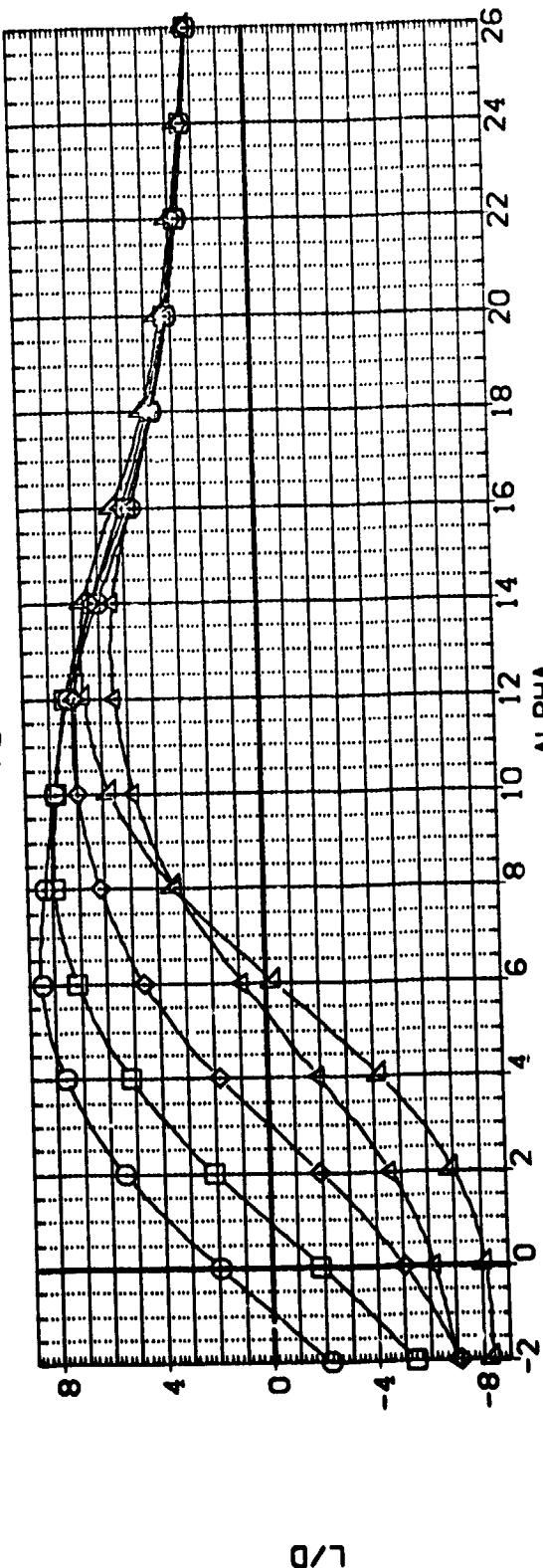
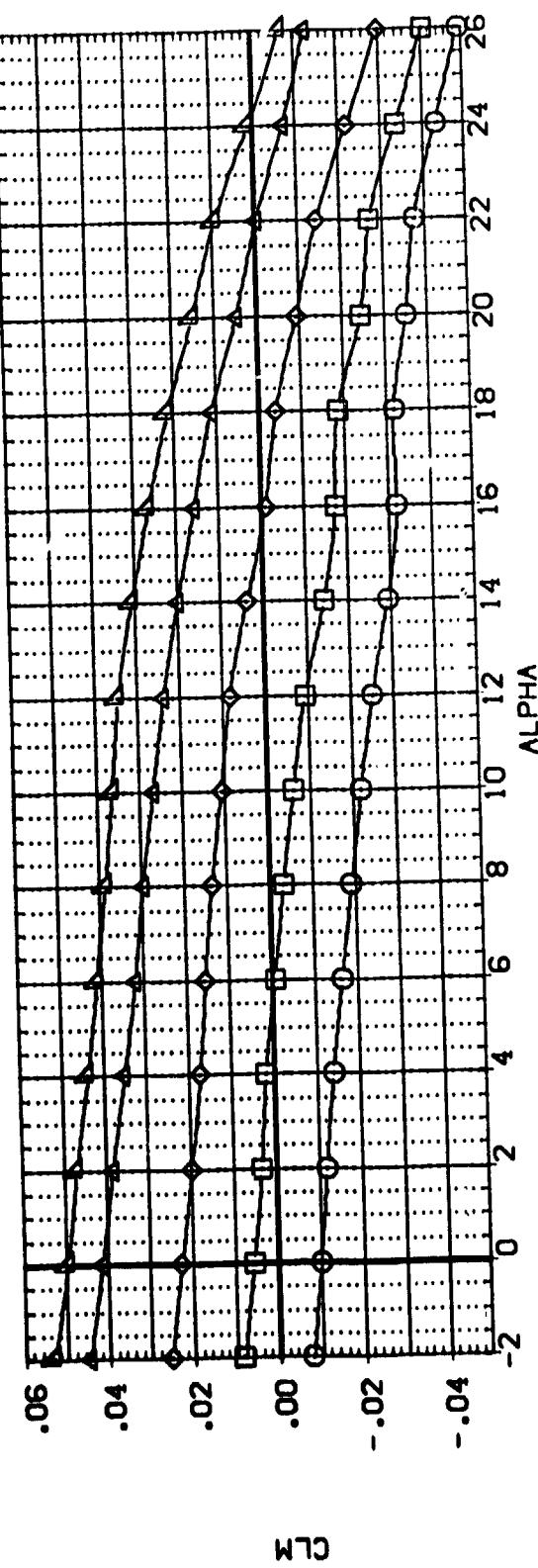
CAJRN/L = 5.40



4 PAGE

כט

DATA SET	NAME	CONFIGURATION INFORMATION				REFERENCE	IN. SCAL.
		DESCRIPTION	AIIRON	BDFLAP	RUFLR		
[FPJ001]	SM001	LC-100 ORBITER (BV) VFB	.000	.000	.000	SREF	49.9824
[FPJ002]	SM002	LC-100 ORBITER (BV) VFB	.000	.000	.000	LREF	13.5000
[FPJ003]	SM003	LC-100 ORBITER (BV) VFB	.000	.000	.000	BRF	10.5151
[FPJ004]	SM004	LC-100 ORBITER (BV) VFB	.000	.000	.000	XMRP	8.9100
[FPJ005]	SM005	LC-100 ORBITER (BV) VFB	.000	.000	.000	YMRP	.0000
[FPJ006]	SM006	LC-100 ORBITER (BV) VFB	.000	.000	.000	ZMRP	.0000



ELEVON EFFECTIVENESS (RUDDER FLARE = 0.0 DEGREES)

$$(\text{A}) \text{RN/L} = 5.40$$

DATA SET SYMBOL CONFIGURATION DESCRIPTION

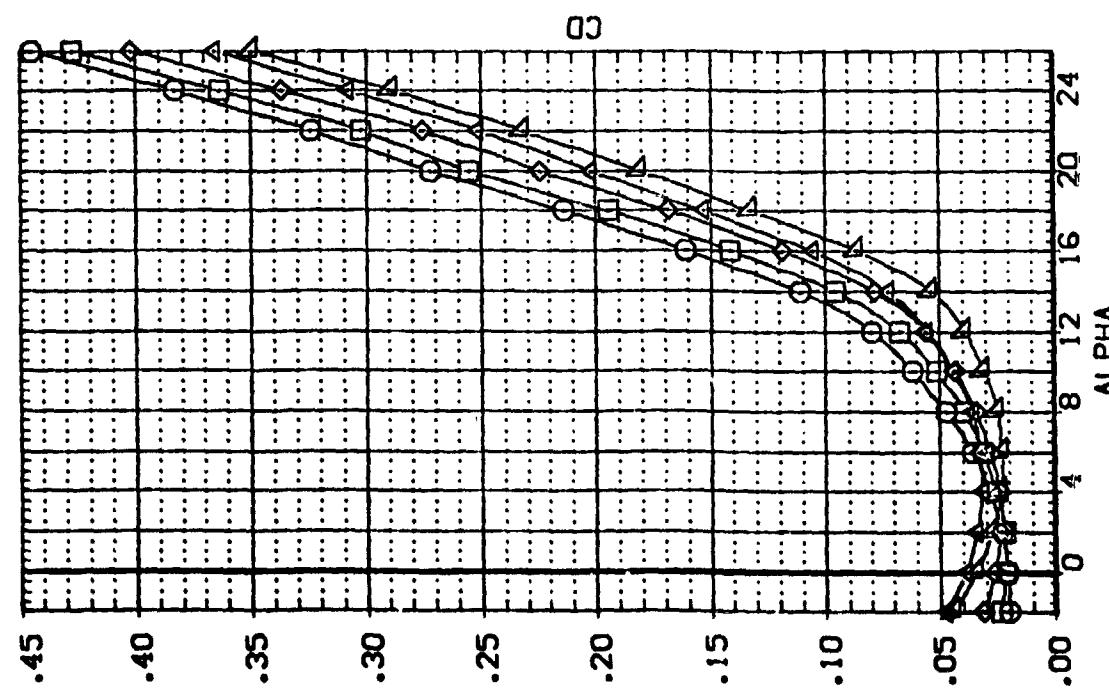
(FPJ001)	○	LA-23(L) IPT-14 LARC LO-100 0881 TTER (BV) VFB
(FPJ002)	□	LA-23(L) IPT-14 LARC LO-100 0881 TTER (BV) VFB
(FPJ003)	◇	LA-23(L) IPT-14 LARC LO-100 0881 TTER (BV) VFB
(FPJ004)	×	LA-23(L) IPT-14 LARC LO-100 0881 TTER (BV) VFB
(FPJ005)	△	LA-23(L) IPT-14 LARC LO-100 0881 TTER (BV) VFB

ELEVTR AILRON ELEVFLR RUDFLR

.000	.000	.000	.000
-.500	.000	.000	.000
-.100	.000	.000	.000
-.150	.000	.000	.000
-.15.000	.000	.000	.000
-.15.000	.000	.000	.000

REFERENCE INFORMATION

50.9824	50. IN.
13.5000	INCHES
10.5151	INCHES
8.9100	INCHES
.0000	INCHES
.0000	INCHES
.0000	INCHES
.0100	SCALE



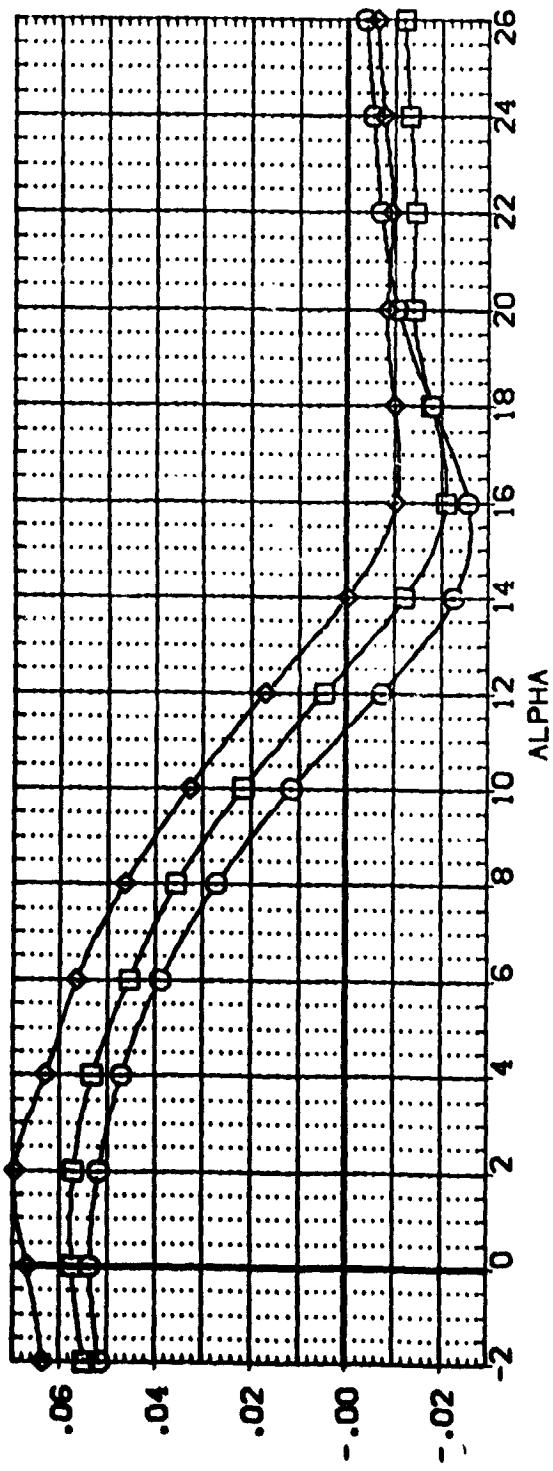
ELEVON EFFECTIVENESS (RUDDER FLARE = 0.0 DEGREES)

CAJRN/L = 5.40

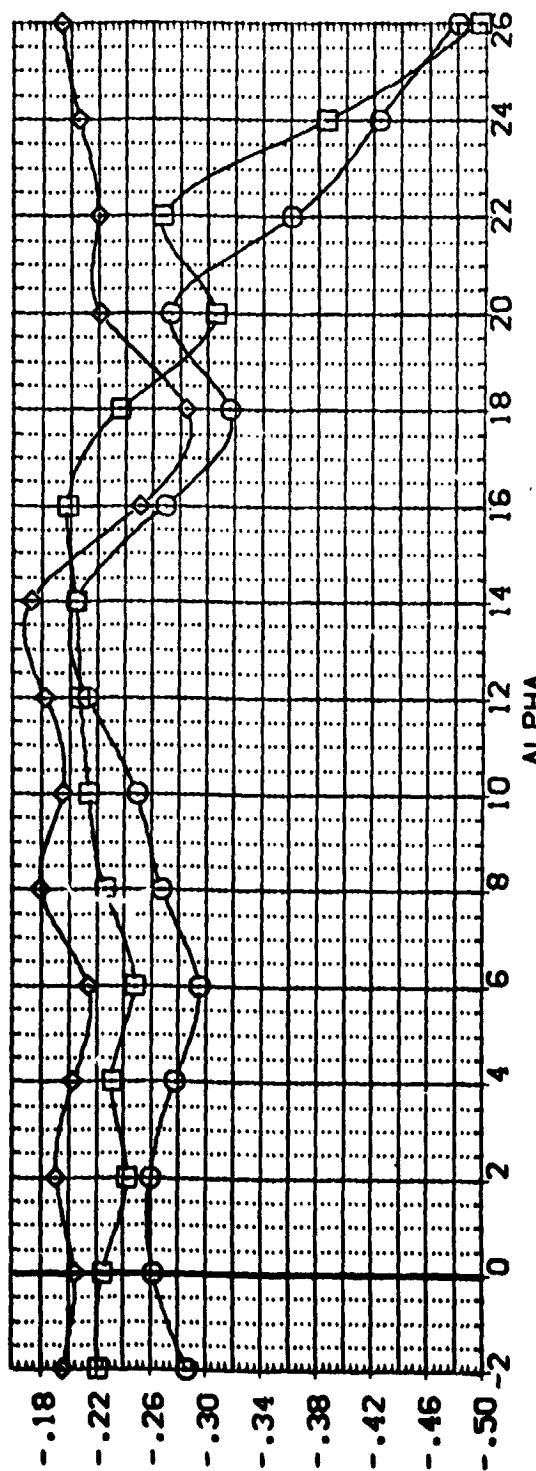
PAGE 6

DATA SET SYMBOL CONFIGURATION DESCRIPTION

(FP)008	LA-231L TPT-141 LARC LD-100 ORBITER (BM)WFB
(FP)007	LA-231L TPT-141 LARC LD-100 ORBITER (BM)WFB
(FP)006	LA-231L TPT-141 LARC LD-100 ORBITER (BM)WFB



CA



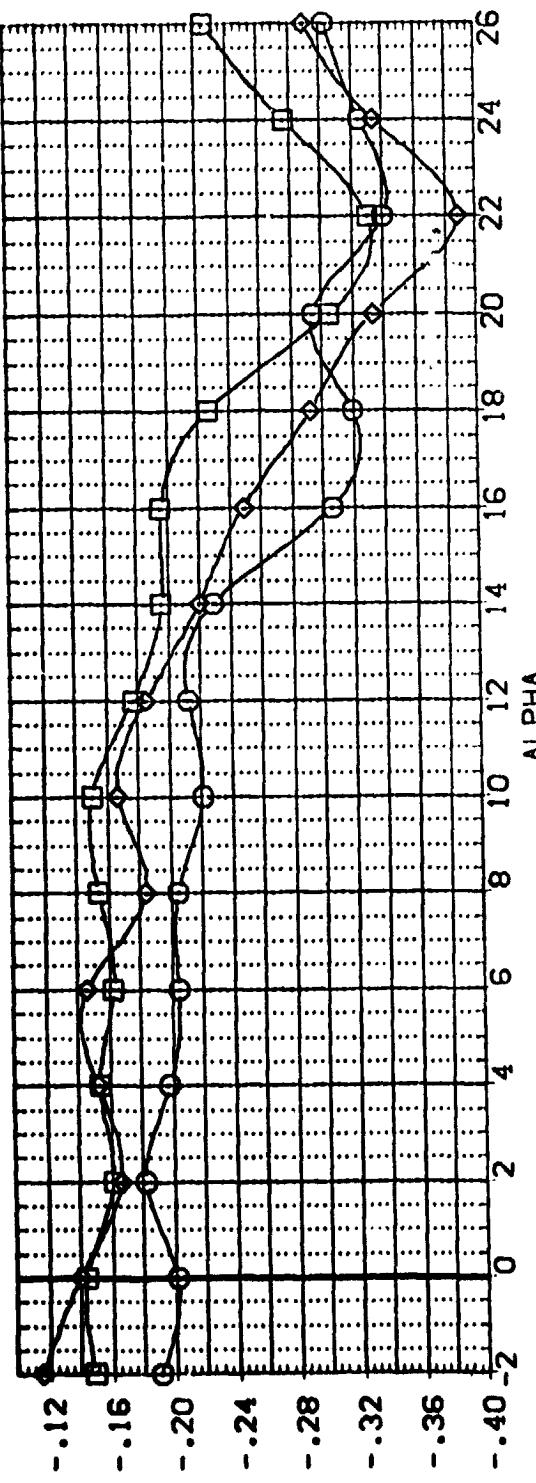
CPB

ELEVON EFFECTIVENESS (RUDDER FLARE = 20.0 DEGREES)

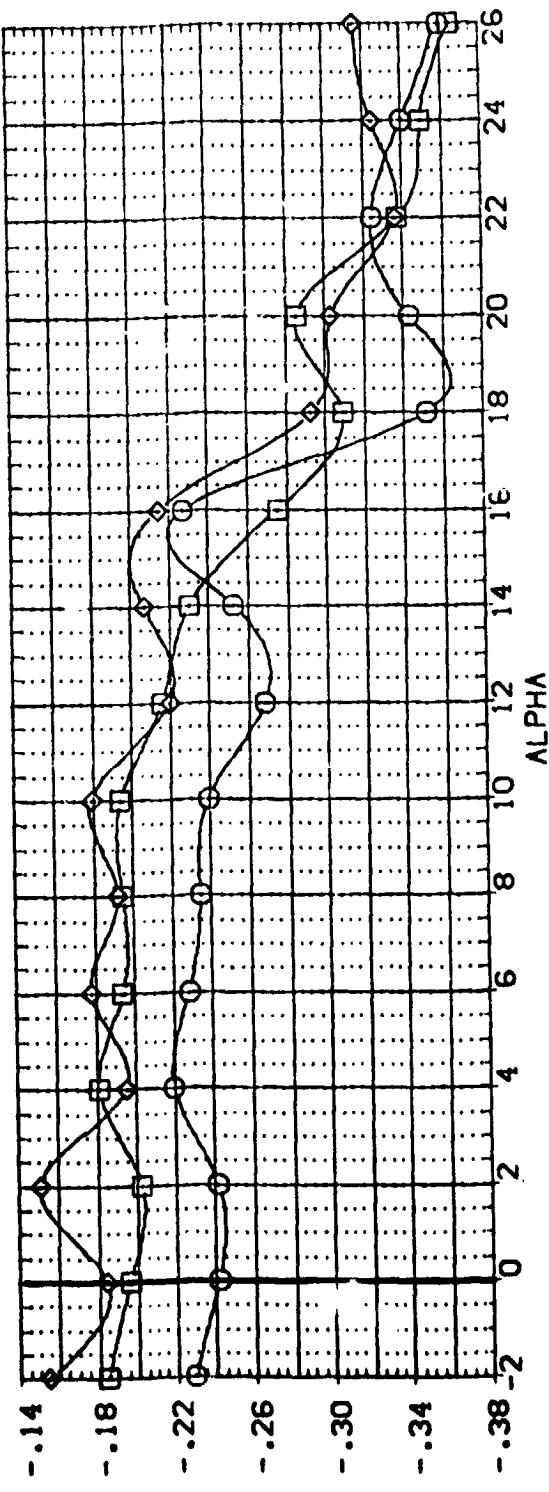
(AJRN/L = 5.40

DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (FP0008) LA-23(LTP-141)ARC LG-100 ORBITER (BN)WF8
 (FP0007) LA-23(LTP-141)ARC LG-100 ORBITER (BN)WF8
 (FP0006) LA-23(LTP-141)ARC LG-100 ORBITER (BN)WF8

REFERENCE INFORMATION
 ELEVTR AILRDN BDFLAP RUFLR
 .000 .000 -18.000 20.000
 .000 .000 -18.000 20.000
 -10.000 .000 20.000 20.000
 -15.000 .000 20.000 20.000
 SREF LREF BREF YREF
 49.9824 13.5000 10.5151 8.9100
 13.5000 10.5151 8.9100 8.0000
 10.5151 8.9100 8.0000 7.0000
 8.9100 8.0000 7.0000 6.0000
 8.0000 7.0000 6.0000 5.0000
 7.0000 6.0000 5.0000 4.0000
 6.0000 5.0000 4.0000 3.0000
 5.0000 4.0000 3.0000 2.0000
 4.0000 3.0000 2.0000 1.0000
 3.0000 2.0000 1.0000 .0000
 2.0000 1.0000 .0000 .0000
 .0000 .0000 .0000 .0100
 SCALE



CPC1



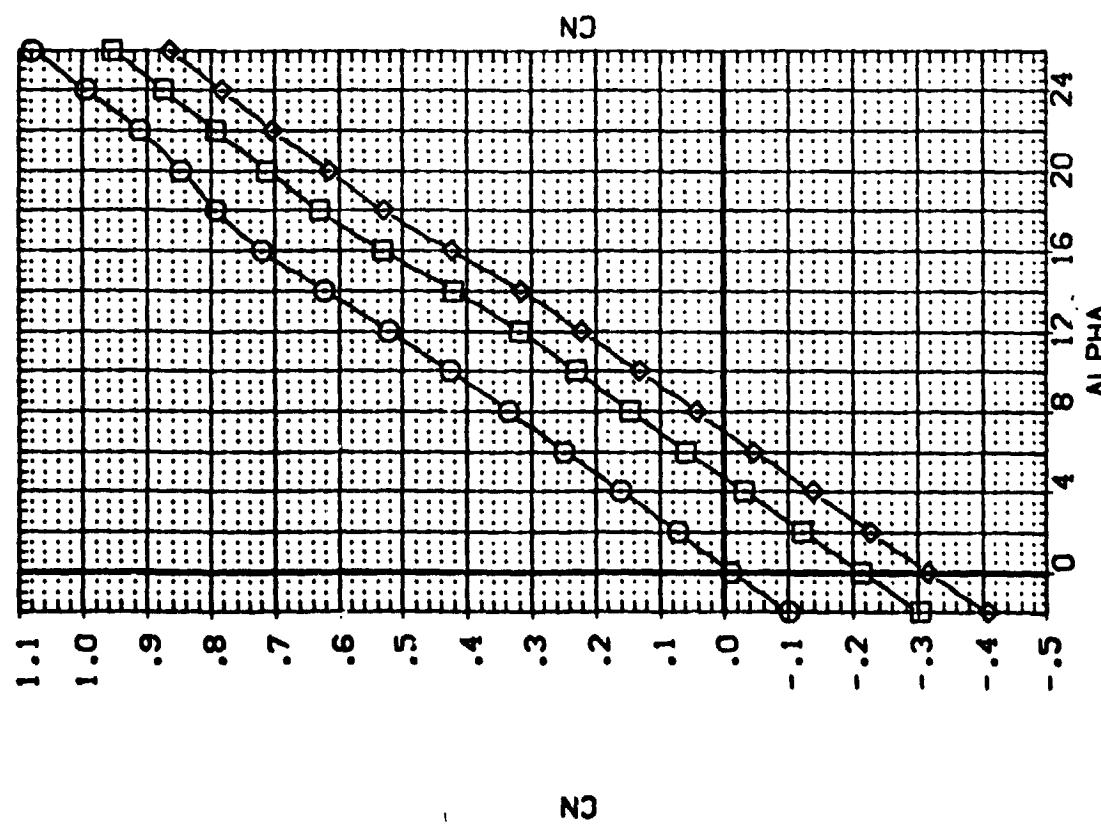
CPC2

ELEVON EFFECTIVENESS (RUDDER FLARE = 20.0 DEGREES)

$(\Delta)_{RN/L} = 5.40$

DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (FP008) 0 LA-23(LTP1-141)ARC LO-100 088 TTER (BMIVFB)
 (FP007) 0 LA-23(LTP1-141)ARC LO-100 088 TTER (BMIVFB)
 (FP006) 0 LA-23(LTP1-141)ARC LO-100 088 TTER (BMIVFB)

REFERENCE INFORMATION
 ELEVTR .000 .000 -18.000 20.000 SREF 19.9824
 AIRLON .000 .000 -18.000 20.000 LREF 13.5000
 BDFLAP .000 .000 -18.000 20.000 BREF 10.5151
 RUFLR -10.000 .000 -18.000 20.000 XMRP 8.9100
 -15.000 .000 -18.000 20.000 YMRP .0000
 .0000 ZMRP .0000
 SCALE .0100



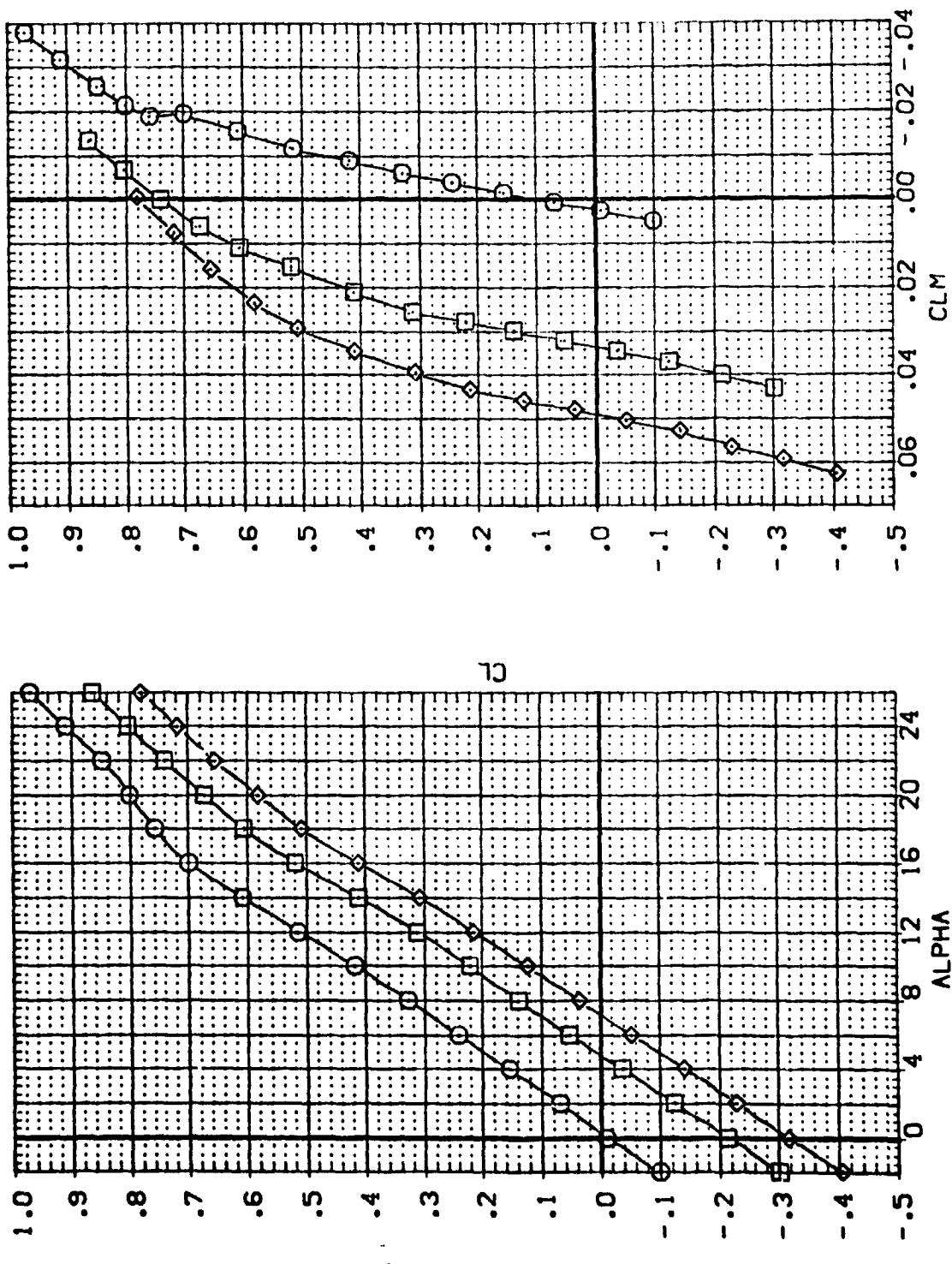
ELEVON EFFECTIVENESS (RUDDER FLARE = 20.0 DEGREES)

(A)RN/L = 5.40

PAGE 9

DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (FRP008)  LA-23(LTP1-141)ARC LG-100 0881ITER (8V1WF8)
 (FRP007)  LA-23(LTP1-141)ARC LG-100 0881ITER (8V1WF8)
 (FRP006)  LA-23(LTP1-141)ARC LG-100 0881ITER (8V1WF8)

ELEVIR AIRDN RUDFLR RUDFLAP REFERENCE INFORMATION
 .000 .000 20.000 SREF 49.9824 SD. IN.
 .000 .000 20.000 LREF 13.5000 INCHES
 -10.000 .000 20.000 BREF 10.5151 INCHES
 -15.000 .000 20.000 XMRP 8.9100 INCHES
 .000 .000 20.000 YMRP .0000 INCHES
 .0000 0.0000 ZMRP .0100 SCALE



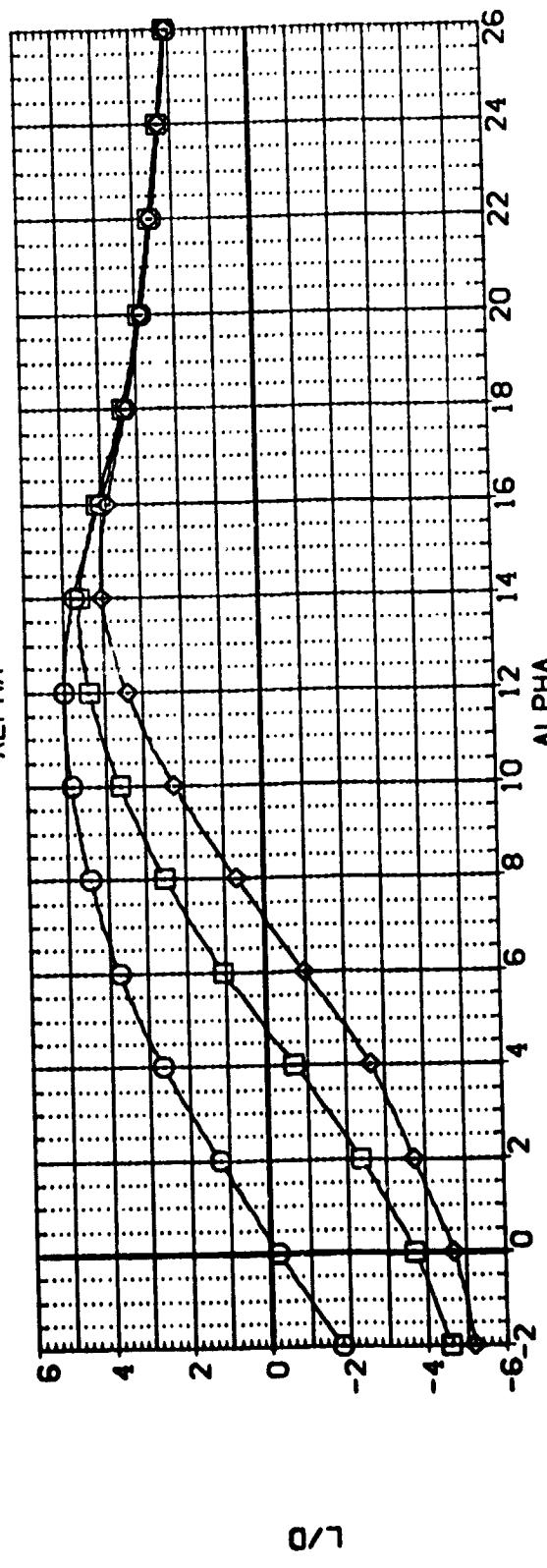
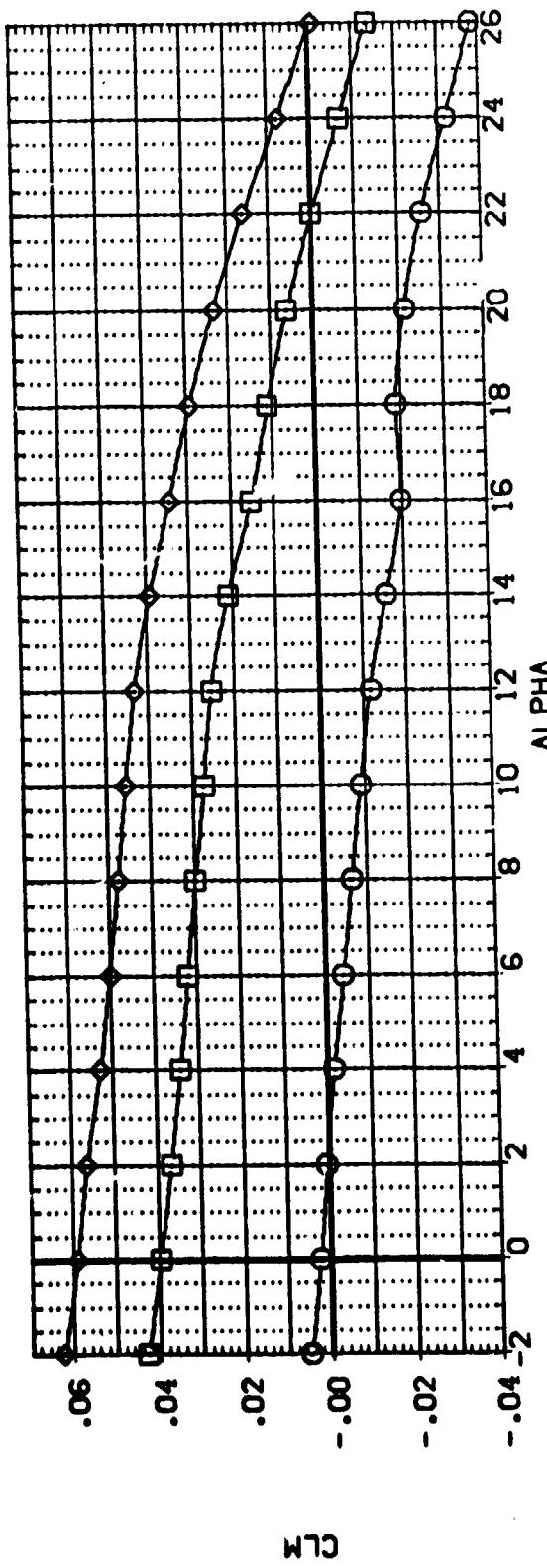
ELEVON EFFECTIVENESS (RUDDER FLARE = 20.0 DEGREES)

$(\Delta)_{RN/1} = 5.40$

PAGE 10

DATA SET NAME: CONFIGURATION DESCRIPTION: L-23(LTP-14) LARC LO-100 0811 TER (6W1WFB)
 (RFP-008) 8 L-23(LTP-14) LARC LO-100 0811 TER (6W1WFB)
 (RFP-007) 8 L-23(LTP-14) LARC LO-100 0811 TER (6W1WFB)
 (RFP-006) 8

REFERENCE INFORMATION
 SP. IN. 49.9824
 SC. IN. 13.5000
 LREF 10.5151
 BREF 8.9100
 XMRP .0000
 YMRP .0000
 ZMRP .0000
 SCALE 1.00

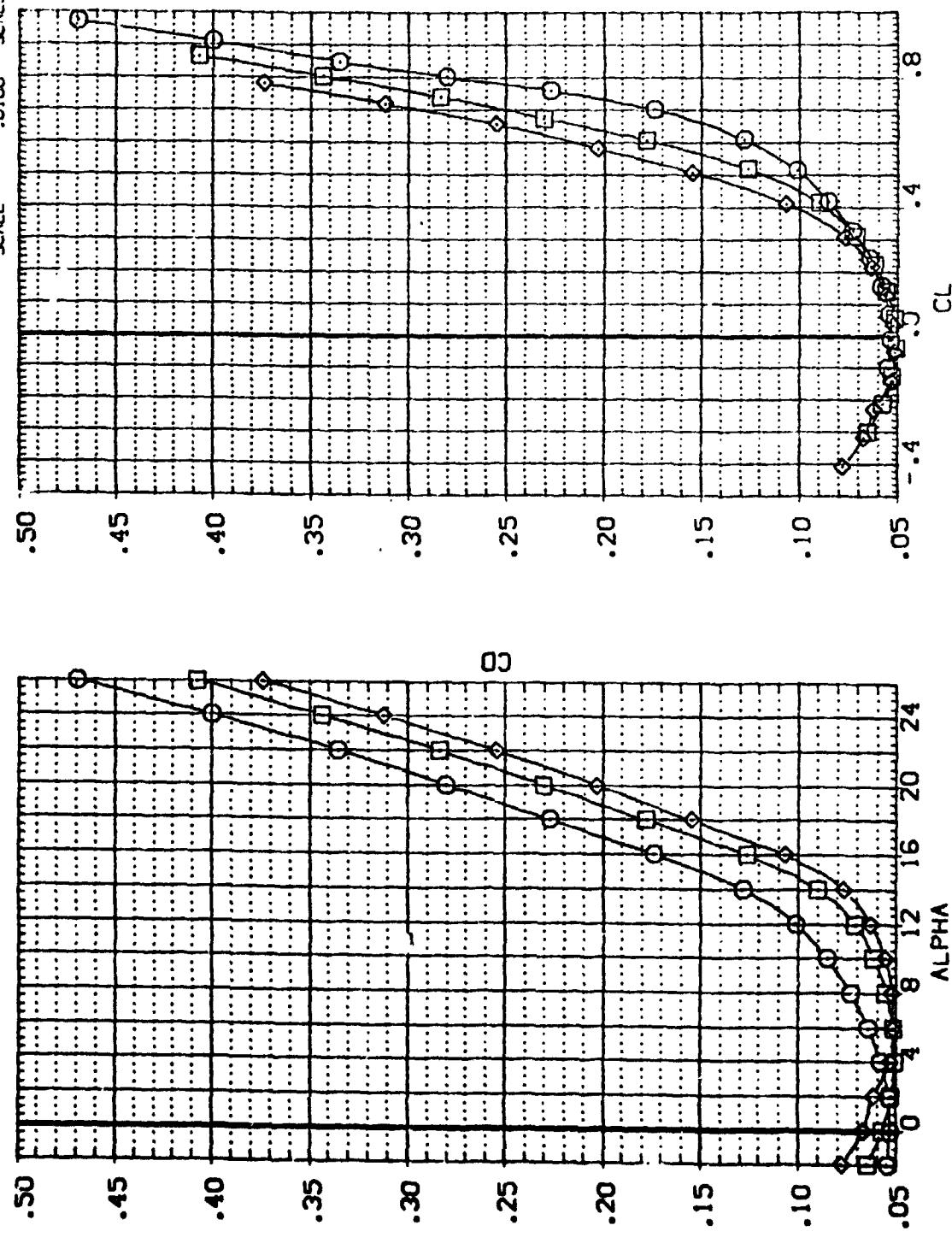


ELEVON EFFECTIVENESS (RUDDER FLARE = 20.0 DEGREES)
 $(\Delta)_{RN/L} = 5.40$

DATA SET SYMBOL CONFIGURATION DESCRIPTION

(FP0005)	LA-23(LTP-14) LARC LD-100 ORBITER (BM1VFB)
(FP0007)	LA-23(LTP-14) LARC LD-100 ORBITER (BM1VFB)
(FP0006)	LA-23(LTP-14) LARC LD-100 ORBITER (BM1VFB)

ELEVTR AIRDN BOFLAP RUFLR
 .000 .000 -18,000 20,000
 -10,000 .000 -18,000 20,000
 -15,000 .000 -18,000 20,000
 SC. IN.
 SREF 4.9824
 LREF 1.3500
 BREF 1.0515
 XHREF 8.9100
 YHREF .0000
 ZHREF .0100
 SCALE



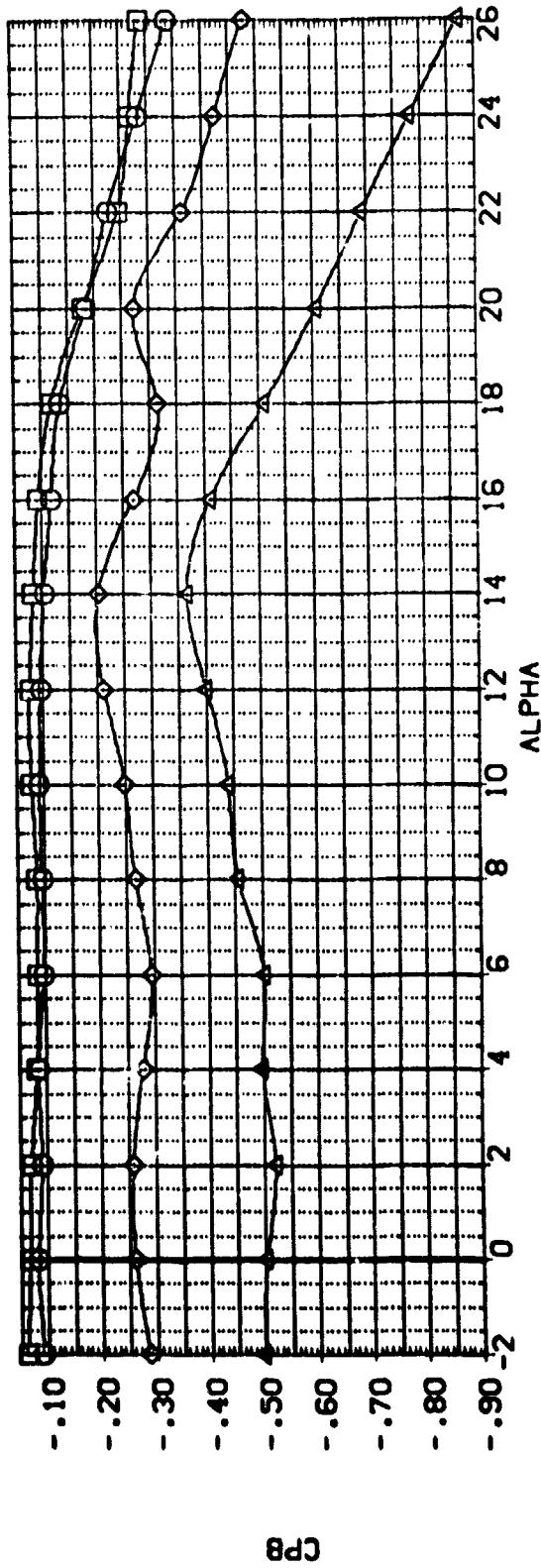
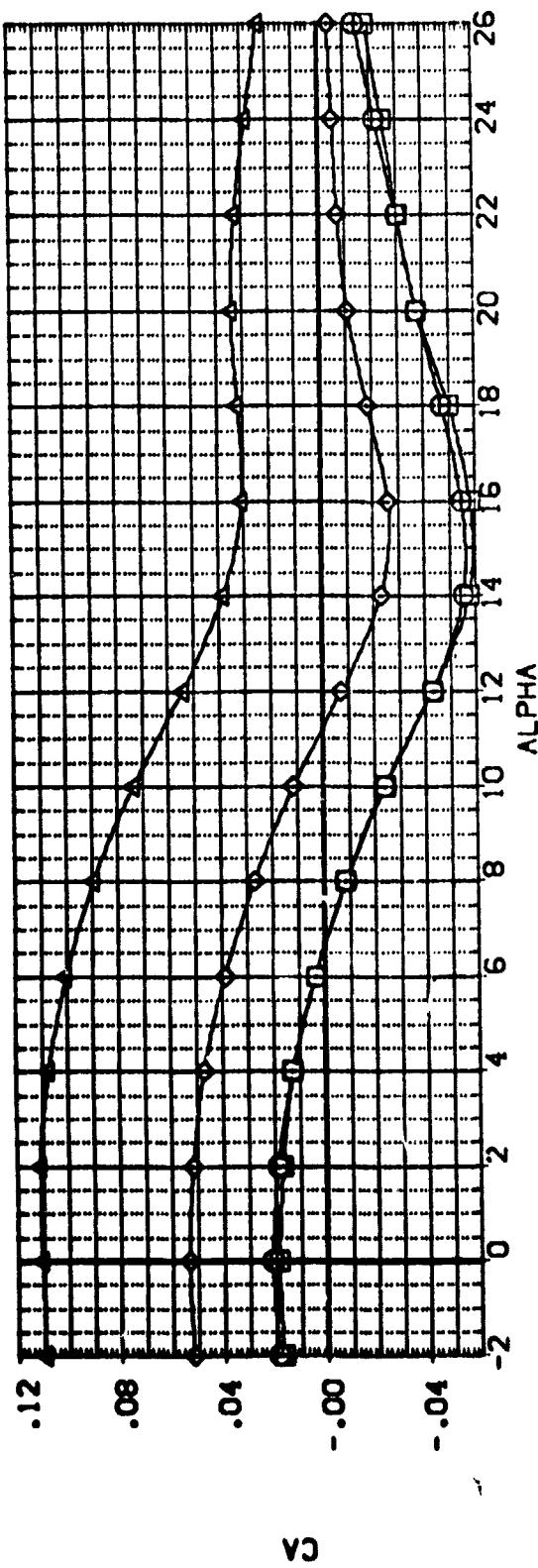
CL

ELEVON EFFECTIVENESS (RUDDER FLARE = 20.0 DEGREES)
 $(\Delta)_{RN/L} = 5.40$

PAGE 12

DATA SET SYMBOL CONFIGURATION DESCRIPTION (BV1VFB)
 (FPJ001) LA-23(LPT-14) LARC LO-100 089 TTER (BV1VFB)
 (FPJ002) LA-23(LPT-14) LARC LO-100 089 TTER (BV1VFB)
 (FPJ003) LA-23(LPT-14) LARC LO-100 089 TTER (BV1VFB)
 (FPJ004) LA-23(LPT-14) LARC LO-100 089 TTER (BV1VFB)

REFERENCE INFORMATION
 SREF 49.9824
 LREF 13.5000
 BREF 10.5151
 XMRP 8.9100
 YMRP .0000
 ZMRP .0100
 SCALE

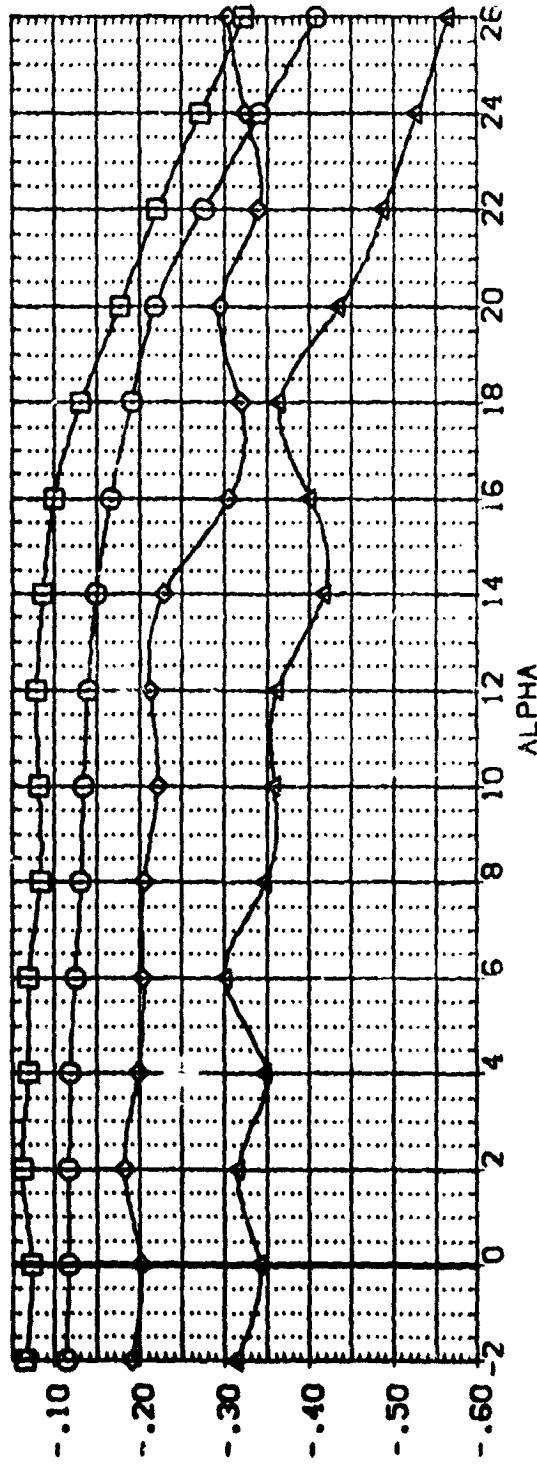


EFFECT OF RUDDER FLARE (ELEVATOR = 0.0 DEGREES)

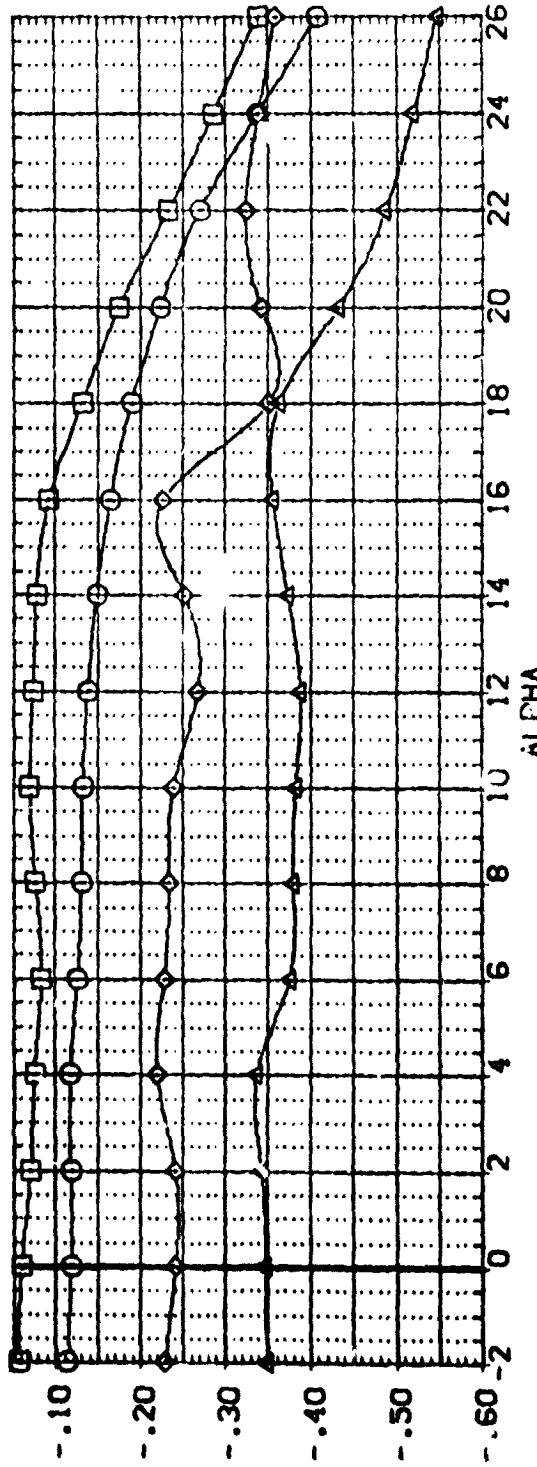
(A)RN/L = 5.40

DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (FPJ001) LA-23(LTP-14) AILAC LO-100 GBTTER (BM)W(B)
 (FPJ002) LA-23(LTP-14) AILAC LO-100 GBTTER (BM)W(B)
 (FPJ003) LA-23(LTP-14) AILAC LO-100 GBTTER (BM)W(B)
 (FPJ010) LA-23(LTP-14) AILAC LO-100 GBTTER (BM)W(B)

ELEVIR AILRDN BDFLAP RUFLR REFERENCE INFORMATION
 :000 :000 :000 :000 SD. IN.
 :000 :000 :000 :000 LREF 49.9824 INCHES
 :000 :000 :000 :000 BREF 13.5000 INCHES
 :000 :000 :000 :000 WREF 10.5151 INCHES
 :000 :000 :000 :000 XREF 9.9100 INCHES
 :000 :000 :000 :000 YREF .0000 INCHES
 :000 :000 :000 :000 ZREF .0100 SCALE



CPC1



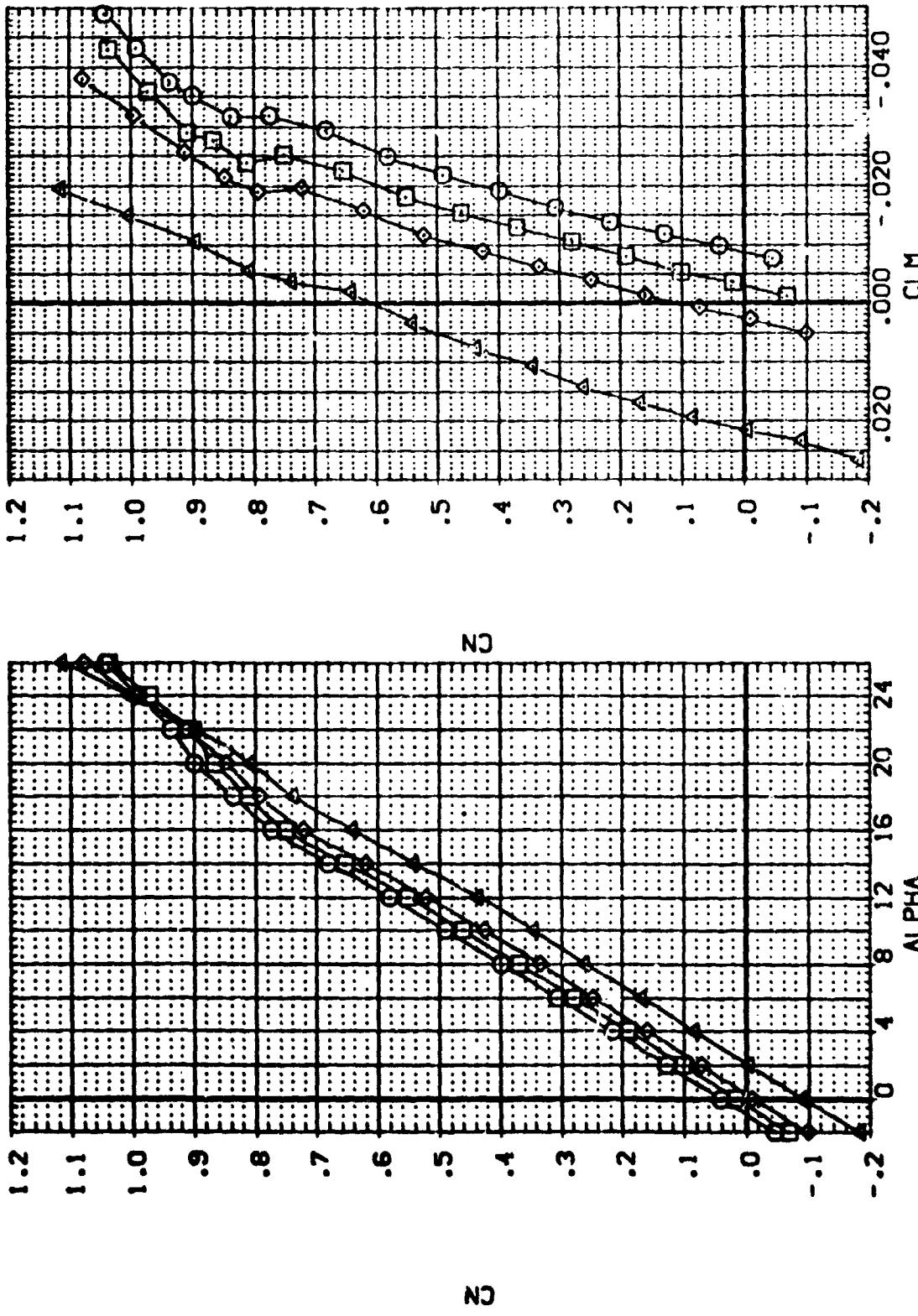
CPC2

EFFECT OF RUDDER FLARE (ELEVATOR = 0.0 DEGREES)
 (A)RN/L = 5.40

PAGE 14

ELEVTR		ALTRON	BDFLAP	BLDFLR	REFERENCE	INFORMATION
.000	.000	.000	.000	.000	SREF	49-3824
.000	.000	.000	.000	.000	LREF	13-5000
.000	.000	.000	.000	.000	0REF	10-5151
.000	.000	.000	.000	.000	XHREF	8-9100
.000	.000	.000	.000	.000	YHREF	8-0000
.000	.000	.000	.000	.000	ZHREF	0-0000
					SCAF	

ELEVTR		AUXLON		BDFLAP		RULFLR		REFERENCE		INFORMATION	
000	000	000	000	000	000	000	000	SREF	49-3824	SC. IN	5
000	000	000	000	000	000	000	000	LREF	13-5000	5	
000	000	000	000	000	000	000	000	BREF	10-5151	5	
000	000	000	000	000	000	000	000	XHREF	8-9100	5	
000	000	000	000	000	000	000	000	YHREF	8-0000	5	
000	000	000	000	000	000	000	000	ZHREF	000000	5	
000	000	000	000	000	000	000	000	SHAP	000000	5	



EFFECT OF RUDDER FLARE (ELEVATOR = 0.0 DEGREES)

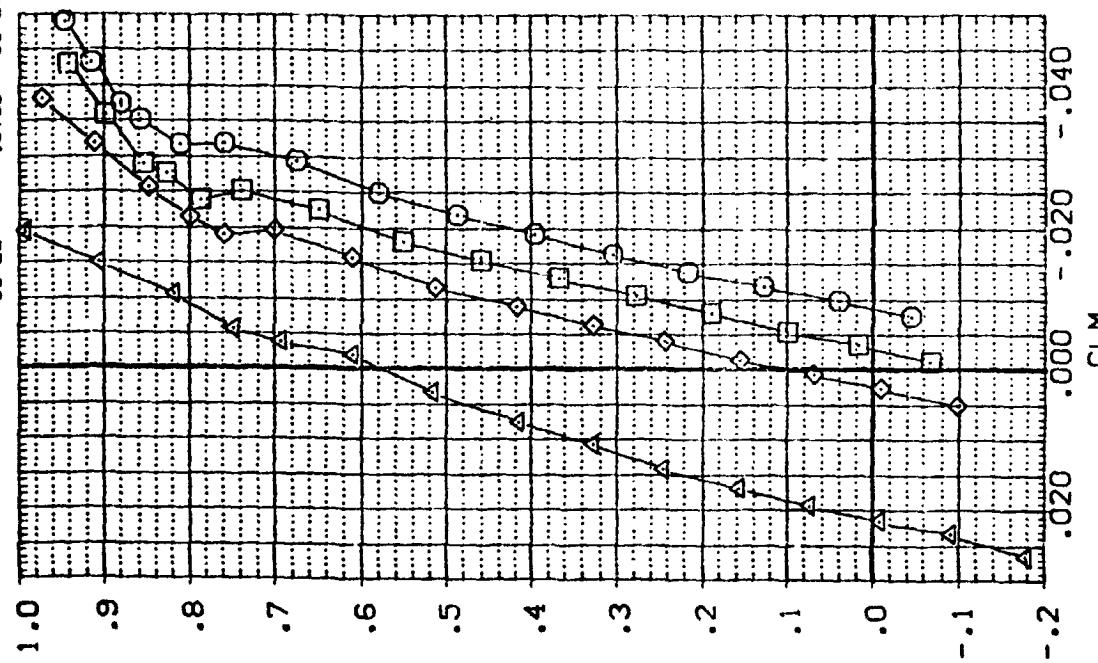
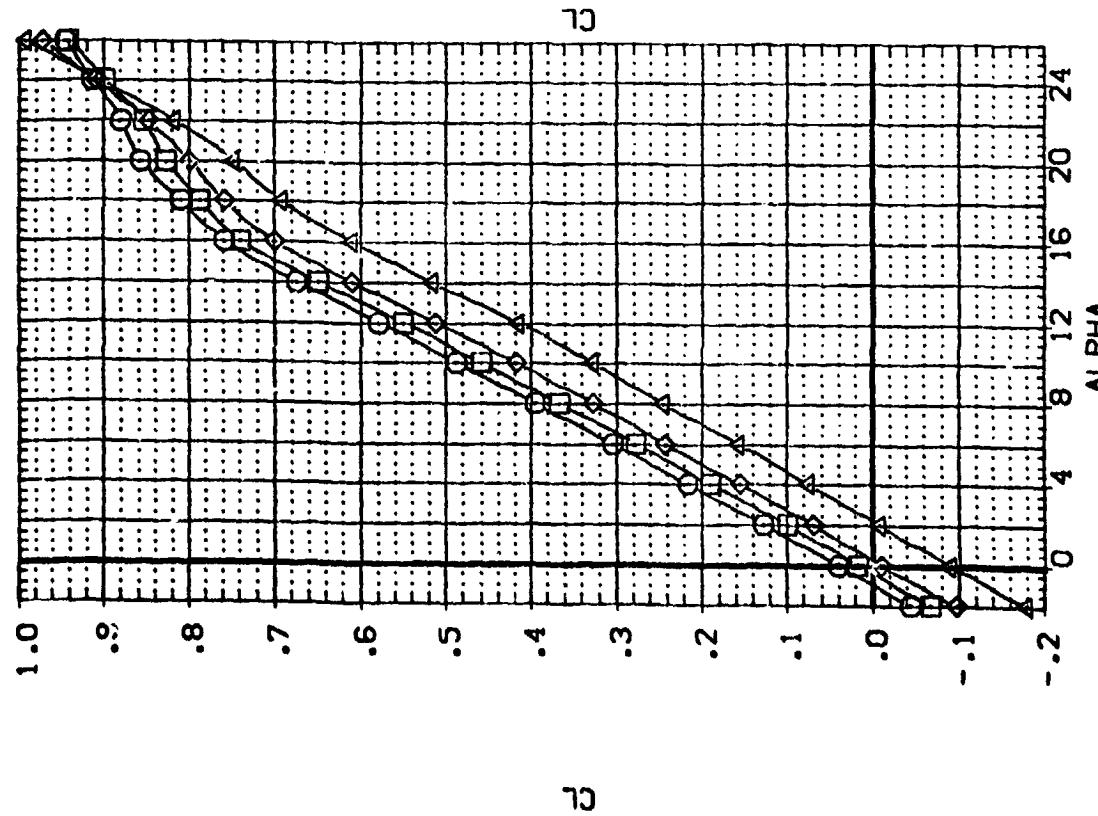
$$(\text{AJRN/L}) = 5.40$$

DATA SET SYMBOL CONFIGURATION DESCRIPTION

[FP-001]	LA-23(LTP-14) LARC	LD-100 ORBITER	(BM) VFB
[FP-009]	LA-23(LTP-14) LARC	LD-100 ORBITER	(BM) VFB
[FP-008]	LA-23(LTP-14) LARC	LD-100 ORBITER	(BM) VFB
[FP-010]	LA-23(LTP-14) LARC	LD-100 ORBITER	(BM) VFB

ELEVTR AILRON BDFLAP RUFLR PREFERENCE INFORMATION

.000	.000	.000	SREF 49.9824
.000	.000	-.18.000	REF 13.5000
.000	.000	.20.000	REF 10.5151
.000	.000	-.18.000	REF 8.9100
.000	.000	.40.000	YHREF .0000
			ZHREF .0100
			SCALE .0100



EFFECT OF RUDDER FLARE (ELEVATOR = 0.0 DEGREES)
 $C_{\text{L}} \text{JRN/L} = 5.40$

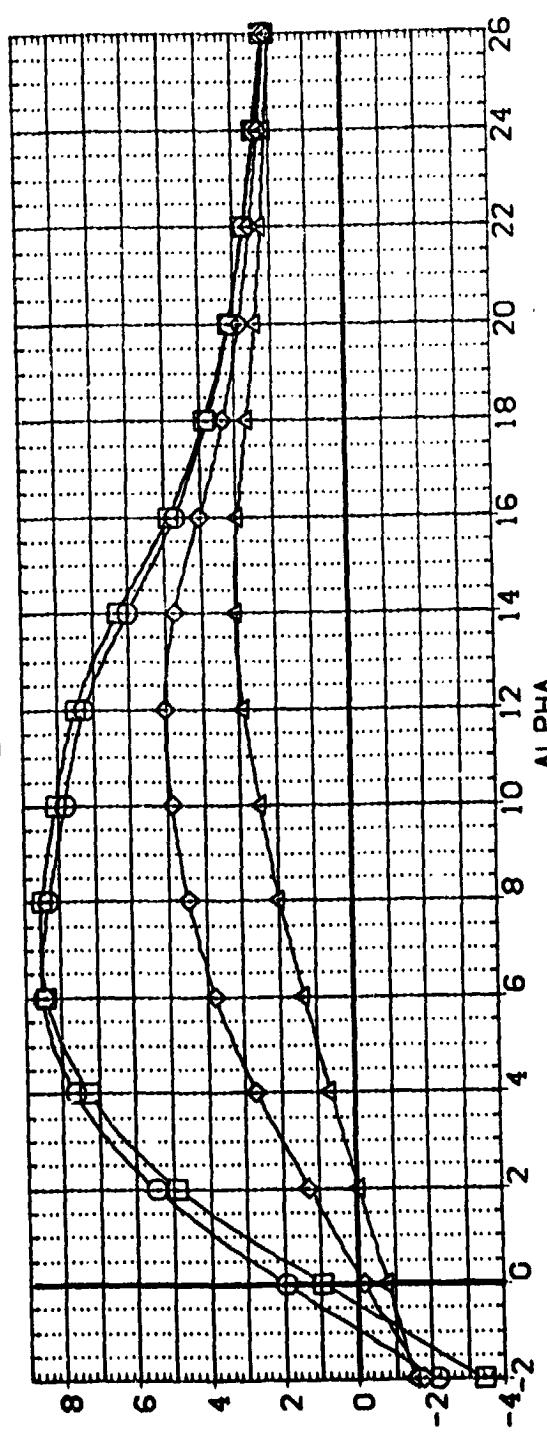
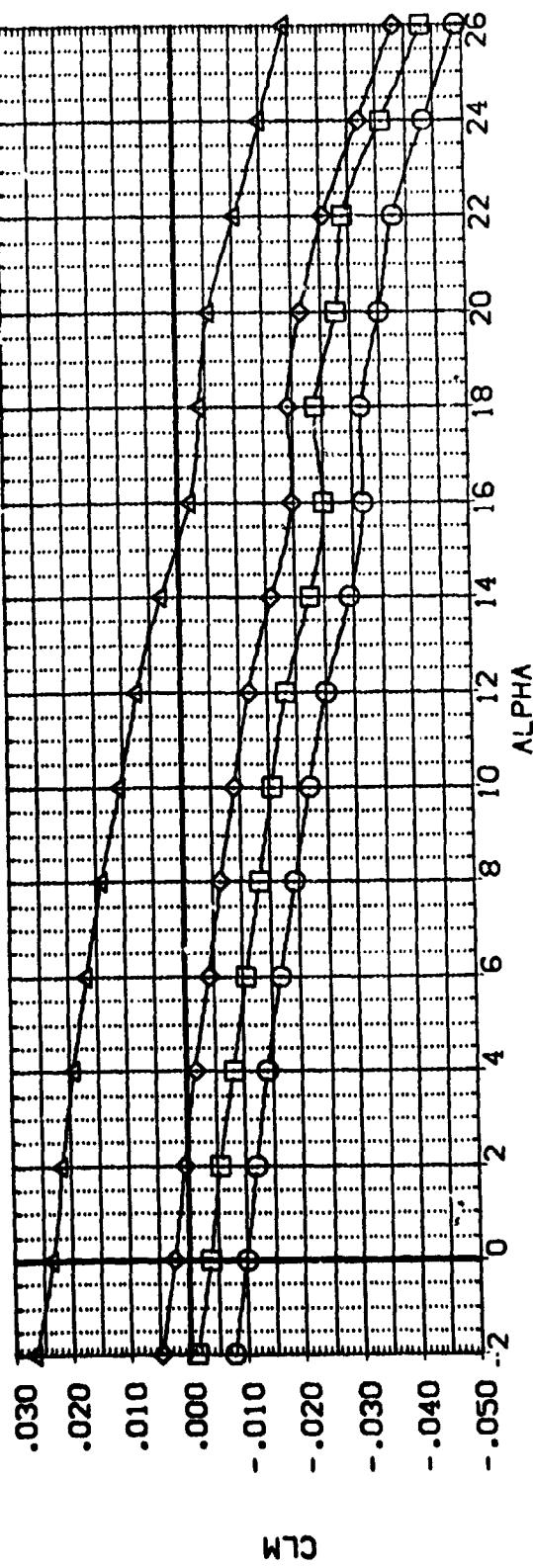
PAGE 16

DATA SET SYMBOL CONFIGURATION DESCRIPTION

[FP0001]	LA-23(IPT-141)ARC	LO-100 ORBITER (BN)VFB
[FP0002]	LA-23(IPT-141)ARC	LO-100 ORBITER (BN)VFB
[FP0003]	LA-23(IPT-141)ARC	LO-100 ORBITER (BN)VFB
[FP0008]	LA-23(IPT-141)ARC	LO-100 ORBITER (BN)VFB
[FP010]	LA-23(IPT-141)ARC	LO-100 ORBITER (BN)VFB

ELEVTR AIRRON BOFLAP RUFLR REFERENCE INFORMATION

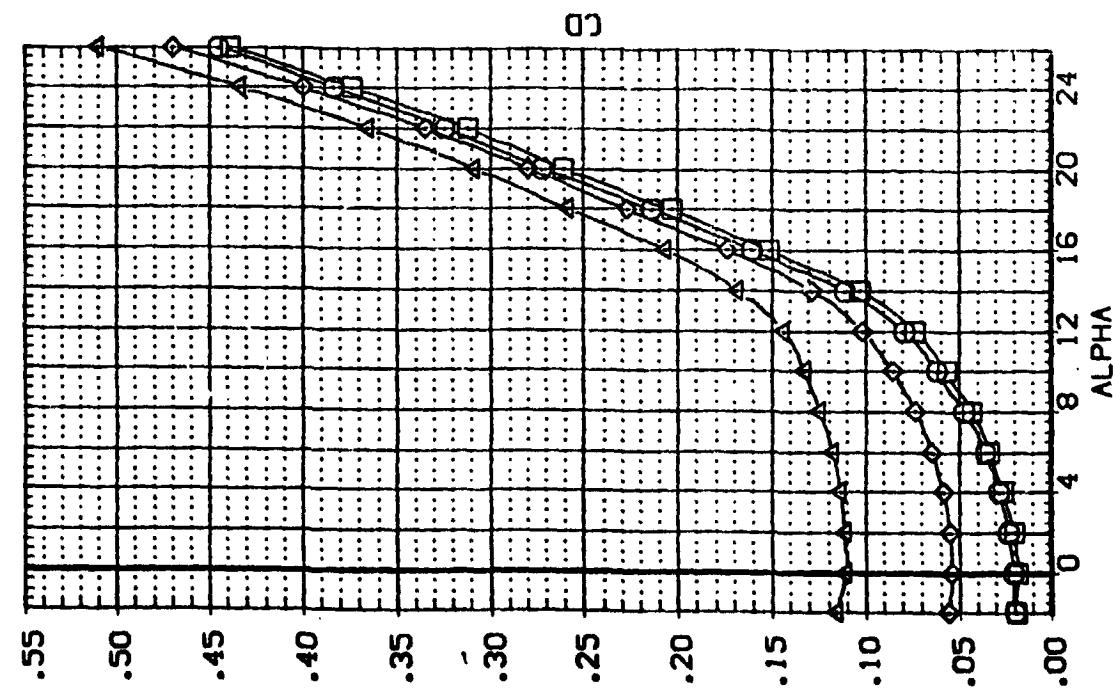
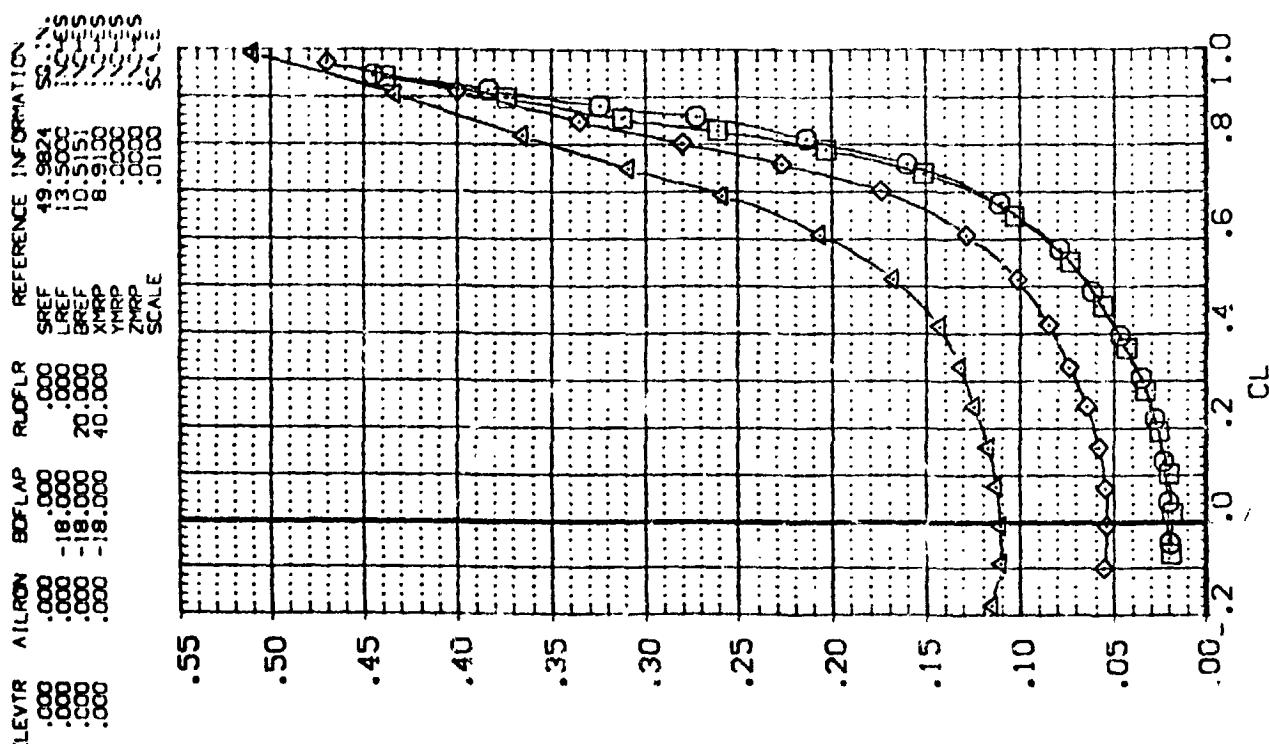
SG:IN:	49.9824
LREF	13.5000
BREF	10.5151
INCES	8.9100
YMPC	.0000
ZMPC	.0000
SCALE	.0100



EFFECT OF RUDDER FLARE (ELEVATOR = 0.0 DEGREES)

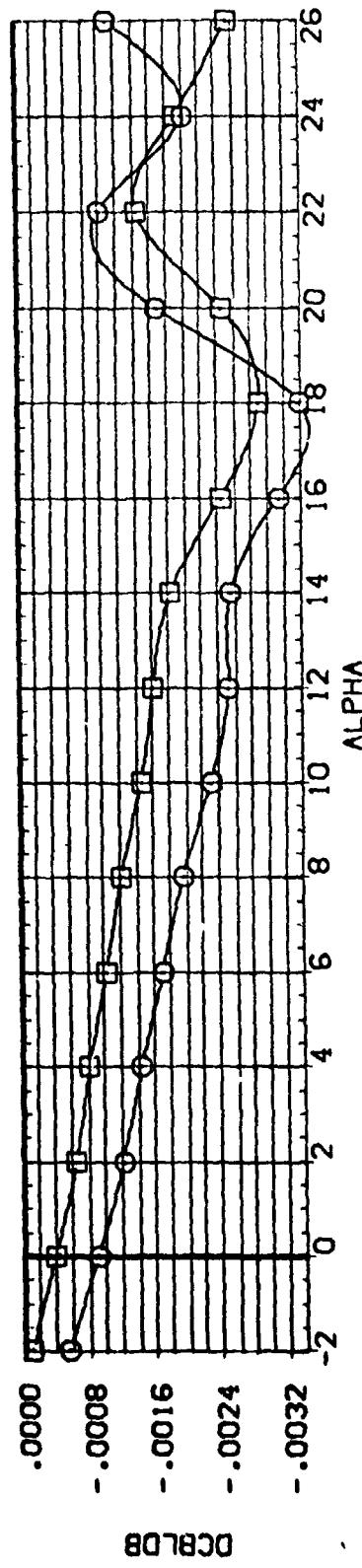
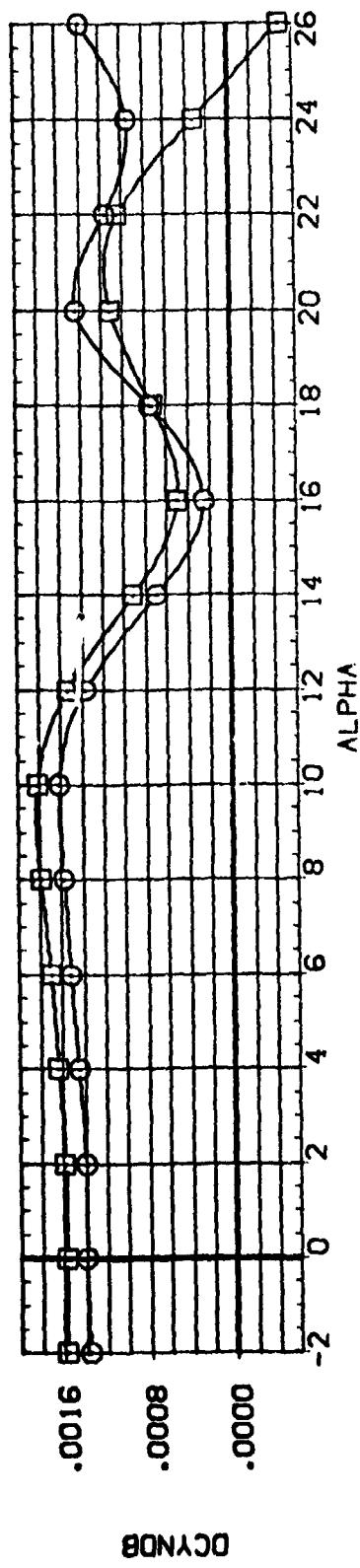
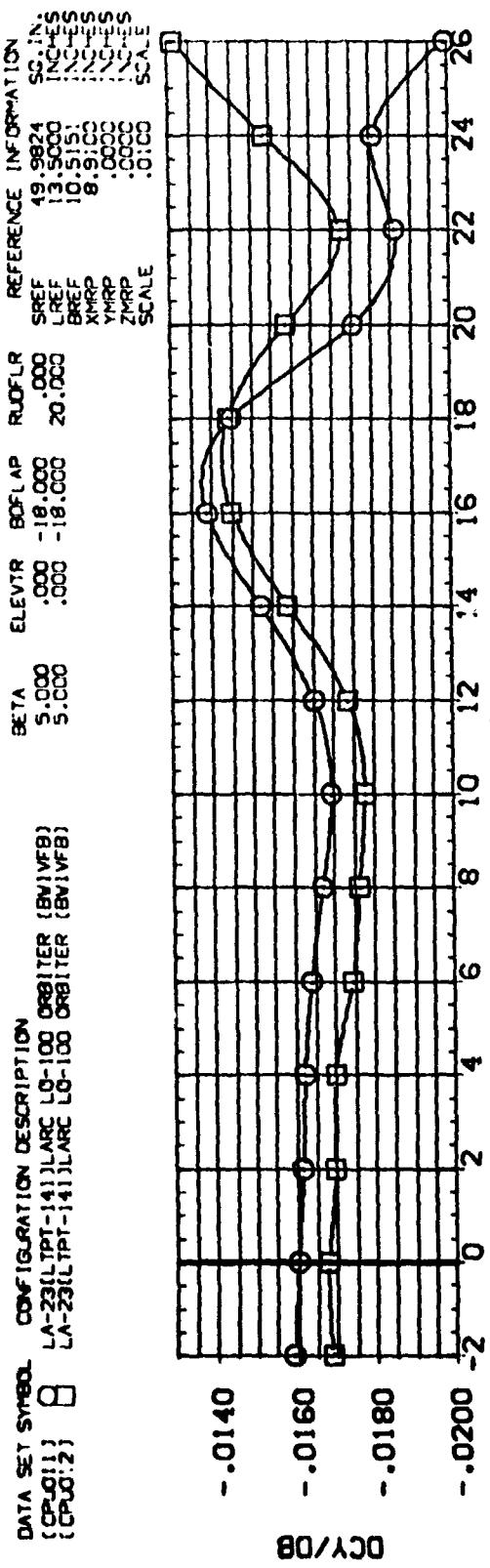
$(A)_{RN/L} = 5.40$

DATA SET SYMBOL CONFIGURATION DESCRIPTION (BV1VFB)
 (FPJ001) LA-23(LPT-14) LARC LO-100 ORB INTER (BV1VFB)
 (FPJ009) LA-23(LPT-14) LARC LO-100 ORB INTER (BV1VFB)
 (FPJ008) LA-23(LPT-14) LARC LO-100 ORB INTER (BV1VFB)
 (FPJ010) LA-23(LPT-14) LARC LO-100 ORB INTER (BV1VFB)



EFFECT OF RUDDER FLARE (ELEVATOR = 0.0 DEGREES)
 $(\Delta)_{RN/L} = 5.40$

DATA SET SYMBOL CONFIGURATION DESCRIPTION
 (CPG011) LA-23(LTP1-14) LARC LG-100 ORBITER (BV)WFB
 (CPG012) LA-23(LTP1-14) LARC LG-100 ORBITER (BV)WFB



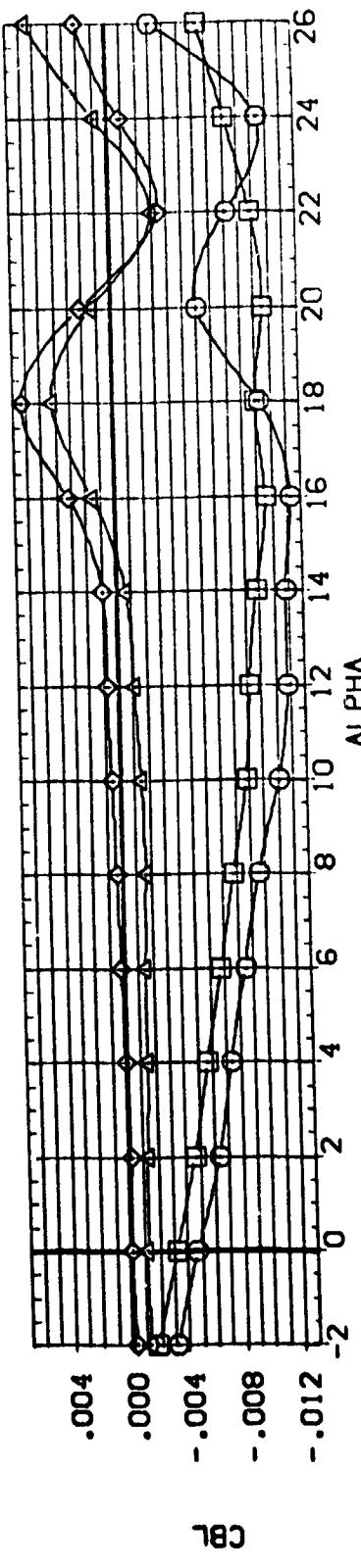
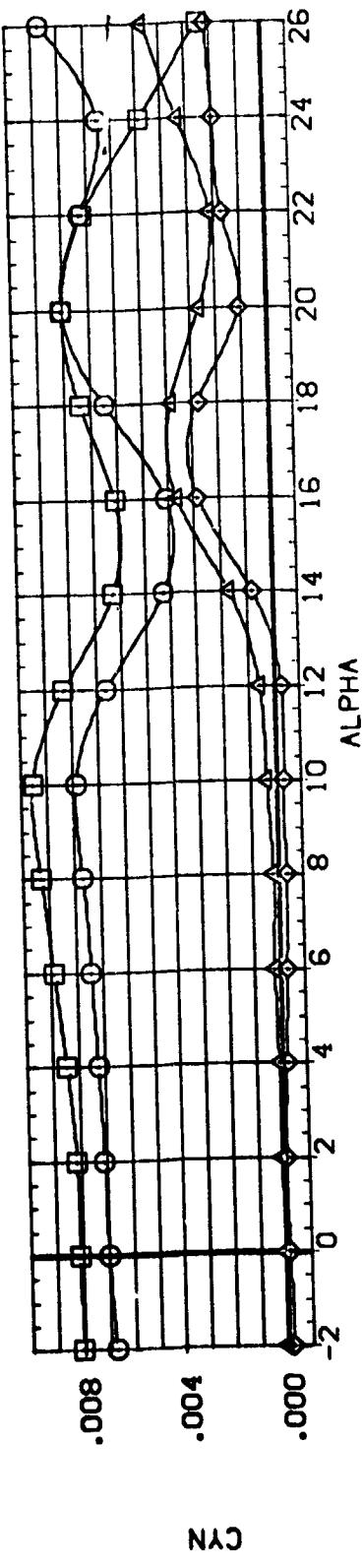
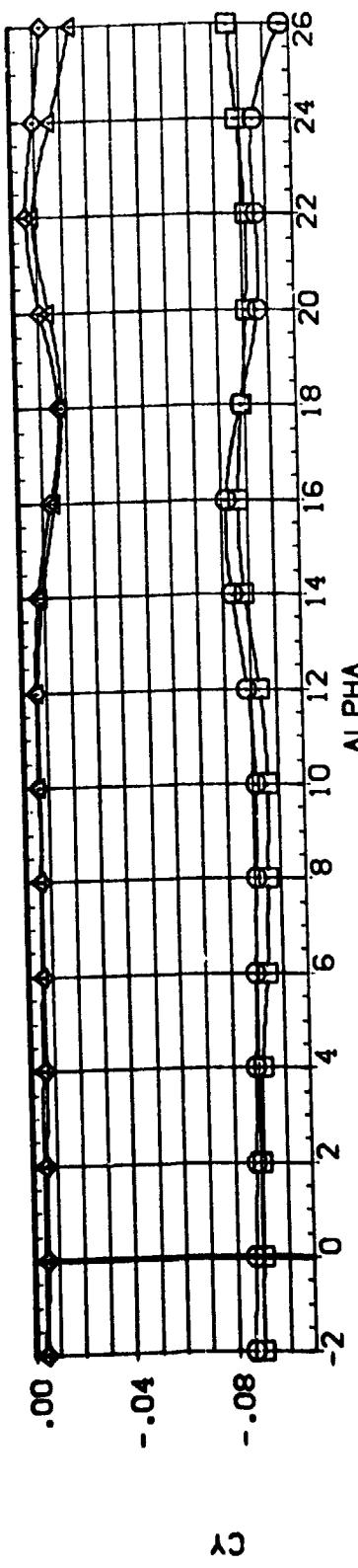
LATERAL-DIRECTIONAL STABILITY CHARACTERISTICS

(A)RN/L = 5.40

PAGE 19

DATA SET SYMBOL CONFIGURATION DESCRIPTION REFERENCE INFORMATION

[APR011]	LA-2311LPT-1411LARC LO-100 ORBITER [BN1VFB]	β TA 5,000	β ELEVTR .000	BFLAP -18,000	ROFLR .000	REFERENCE 49 9824
[APR012]	LA-2311LPT-1411LARC LO-100 ORBITER [BN1VFB]	5,000	.000	-18,000	20,000	SCALE .0000 INCHES
[APR009]	LA-2311LPT-1411LARC LO-100 ORBITER [BN1VFB]	5,000	.000	-18,000	20,000	REF 13 5200
[APR008]	LA-2311LPT-1411LARC LO-100 ORBITER [BN1VFB]	5,000	.000	-18,000	20,000	REF 10 5151
		0,000	.000	-18,000	20,000	YMRP .0100
		0,000	.000	-18,000	20,000	ZMRP .0000
		0,000	.000	-18,000	20,000	SCALES .0000 INCHES



LATERAL-DIRECTIONAL STABILITY CHARACTERISTICS

$(\Delta)_{RN/L} = 5.40$

PAGE 20

APPENDIX

TABULATED SOURCE DATA

Plotted data tabulations are
available on request from DMS.

DATE 24 SEP 73

TABULATED SOURCE DATA, LARC LTFT 141

PAGE 1

LA-23 (LTFT-141) LARC LO-105 ORBITER (NOVFB)

(17 AUG 73)

REFERENCE DATA

SPHER	=	49.3024 56.18.	XREFP	=	8.9100 INCHES
UNEF	=	13.3000 INCHES	YREFP	=	.0000 INCHES
SPHER	=	10.5191 INCHES	ZREFP	=	.0000 INCHES
SCALE	=	.5000 SCALE			

REFERENCE DATA

SPHER	=	.00000	BETA	=	.00000
UNEF	=	-.00000	CR	=	0.00000
SPHER	=	-.00000	CLW	=	-.00741
SCALE	=	.50000	CLN	=	.00001

RUN NO. 2/0 RNL = 5.30 GRADIENT INTERVAL = -5.00/ 5.00

SPHER	ALPHAW	BETA	CR	CLW	CLN	CW	CY	CRB	CPC1	CPC2
5.300	-2.227	.00000	-.00436	.01673	-.00741	.00001	-.000017	-.000035	-.000022	-.11109
5.357	-1.328	.01063	-.00000	.02025	-.00007	.00011	-.000009	-.000023	-.000017	-.11561
5.368	-.069	.01220	-.00423	.02107	-.00006	.00012	-.000016	-.000022	-.000017	-.11560
5.374	1.125	.01075	-.00944	.01978	-.01105	.00007	-.000022	-.000050	-.000037	-.11579
5.382	2.363	.01125	-.00863	.01815	-.01221	.00012	-.000019	-.000047	-.000037	-.11654
5.389	4.454	.01062	-.00666	.01110	-.01441	.00011	-.000016	-.000043	-.000031	-.11624
5.393	6.826	.01176	-.00621	.00932	-.01720	.00004	-.000012	-.000046	-.000031	-.11636
5.398	8.893	.01127	-.00402	-.01440	-.02040	.00016	-.000024	-.000056	-.000033	-.12567
5.409	10.950	.01136	-.00364	-.01271	-.02342	.00020	-.000047	-.000106	-.000032	-.12772
5.374	13.273	.00983	-.00214	-.012765	-.010012	.000077	-.000013	-.000042	-.000042	-.13206
5.394	15.561	.00479	-.001516	-.013194	-.002719	.000361	-.000020	-.000037	-.000037	-.13374
5.359	17.669	.00198	-.00035	-.013146	-.001448	.000234	-.000015	-.000039	-.000039	-.14436
5.392	19.652	.001031	-.00021	-.013492	-.00175	.000195	-.000024	-.000037	-.000037	-.14238
5.364	21.637	.00057	-.00015	-.013723	-.001387	.000168	-.000019	-.000038	-.000038	-.15982
5.377	24.375	.00039	-.00167	-.02164	-.04331	.00030	-.000026	-.000045	-.000045	-.16677
	GRADIENT	.00014	-.00014	-.00114	-.00103	-.00001	-.000023	-.000056	-.000062	-.22054

PARAMETRIC DATA

BETA1	=	.000
ELEVTR	=	.000
BOFLAP	=	.000
RUDFLR	=	.000

LA-23 (LTPT-141) LARC LC-120 ORBITER (241 VFB)

(RPT02) (17 AUG 73)

REFERENCE DATA

SHFT = .69-.9624 SQ. IN. XHYP = 6.9150 INCHES
 LREF = 13.9270 INCHES YHYP = .0000 INCHES
 DREF = 17.5151 INCHES ZHYP = .5000 INCHES
 SCALE = .5125 SCALE

PARAMETRIC DATA

BETA = .0000 MACH = .167
 ELEVTR = -5.000 AIRDN = .0000
 EDFLAF = .0000 RUDFLR = .0000

RNL	ALPHA	BETA	CN	CA	CLW	CBL	CYN	CY	CFB	CFC1	CFC2
5.359	-2.352	.01124	-.14895	.01869	.00169	.00050	-.00775	-.00421	-.00742	-.10713	
5.357	-1.156	.01011	-.09106	.02378	.00117	.00052	-.00773	-.00160	-.11060	-.11178	
5.356	-1.054	.01079	-.04449	.02157	.00167	.00046	-.00601	-.00017	-.11197	-.11124	
5.345	1.037	.00997	.00997	.02154	.00150	.00046	-.00759	-.00996	-.11052	-.11164	
5.336	2.134	.01111	.03259	.02016	.00342	.00113	.00204	.00810	-.00236	-.11679	
5.344	3.233	.01066	.09931	.01407	.00114	.00059	-.00631	-.00879	-.11663	-.11722	
5.356	4.307	.01099	.14992	.01466	.00149	.00055	-.00634	-.00870	-.11621	-.11914	
5.337	6.314	.01163	.24776	.00283	-.00127	.00056	-.00688	-.00642	-.10611	-.12015	
5.355	8.635	.01070	.34964	-.01012	-.00335	.00193	.00277	-.00895	-.12676	-.12699	
5.361	10.964	.00963	.45193	-.02735	-.00157	.00110	.00292	-.00894	-.13664	-.13847	
5.325	13.225	.00963	.56365	-.0476	-.00214	.00117	.00973	-.13077	-.15161	-.15554	
5.341	15.472	.00759	.67676	-.05450	-.01728	.00266	-.01423	-.13377	-.17158	-.16992	
5.313	17.662	.01177	.76156	-.04655	-.01291	.00529	-.01309	-.01743	-.14742	-.20037	
5.306	19.849	.01463	.86933	-.03962	-.02458	.00304	-.00336	-.01374	-.17323	-.22145	
5.373	1.364	.00294	.89317	-.03495	-.02687	-.00282	.00230	-.00930	-.25605	-.26706	
5.321	23.972	.00761	.95529	-.02789	-.02339	.00255	.00219	-.01216	-.25926	-.31071	
GRADIENT	.00712	.04397	.02761	-.02116	-.01116	.00210	.00210	-.00151	-.00129	-.00151	

LA-23 (LTPT-142) LARC LC-100 ORBITER (641/68)

(RFU0003) (17 AUG 73)

REFERENCE DATA

SHFT =	49.9024	SD. IN.	300P =	6.9155 INCHES
LREF =	13.3270	INCHES	310P =	.0000 INCHES
BARY =	15.5151	INCHES	320P =	.0000 INCHES
SCALE =	.0000	SCALE		

PARAMETRIC DATA

RUN NO.	A/ D	INCL =	5.38	GRADIENT INTERVAL =	-5.00/ 5.00	PARAMETRIC DATA					
						ALPHA	BETA	CH	CA	CLW	CLB
5.360	-2.412	.01021	-.21177	.02244	-.00282	.00100	-.00051	-.00440	-.00984	-.10462	
5.379	-1.320	.01327	-.16926	.02492	-.00223	.00082	-.00041	-.00472	-.00912	-.11095	
5.387	-1.124	.02363	-.13799	.02650	-.00293	.00154	-.00032	-.00467	-.00927	-.11264	
5.375	1.080	.01055	-.06614	.02634	-.00112	.00023	-.00021	-.00532	-.01014	-.11236	
5.367	2.116	.01037	-.03666	.02513	-.00179	.00022	-.00017	-.00584	-.01080	-.11305	
5.361	3.289	.01129	-.01164	.02691	-.00138	.00014	-.00026	-.00651	-.00996	-.11420	
5.350	4.284	.01159	-.03649	.02773	-.00176	.00000	-.00003	-.00654	-.01225	-.12196	
5.345	6.420	.01059	-.14615	.01281	-.01936	-.00111	-.00213	-.00668	-.01288	-.12630	
5.349	8.662	.01057	-.01079	.02662	-.00222	.00179	-.00019	-.00715	-.01794	-.13494	
5.370	10.302	.01156	.34933	-.01756	.00359	.00032	-.00020	-.00760	-.01302	-.14314	
5.366	13.114	.02074	.44729	-.03654	.00622	.00043	-.00040	-.00716	-.01482	-.15467	
5.370	15.320	.02097	.57116	-.36934	.00515	.00055	-.00157	-.01092	-.014815	-.16884	
5.361	17.626	.01003	.67599	-.13497	-.00325	.00286	-.00218	-.01321	-.016075	-.18074	
5.322	19.709	.01232	.73796	-.04112	-.00455	.00374	.00147	-.01294	-.015947	-.21030	
5.327	21.620	.00322	.61821	-.03676	-.00378	.00246	.00162	-.001796	-.00804	-.23871	
5.363	23.902	.02078	.69764	-.03159	-.02197	-.00134	.00211	-.004862	-.01768	-.28476	
	GRADIENT	.00016	.04479	-.00209	-.00135	.00015	.00017	-.00035	-.00151	-.00178	

LA-23 (LTPT-141) LARC LO-11: ORBITER 1941 (FB)

(RPT004) (17 AUG 73)

REFERENCE DATA

BREF =	49.9824 58.161.	XREF =	8.9550 INCHES
LREF =	13.3223 INCHES	YREF =	.0020 INCHES
GREF =	15.3151 INCHES	ZREF =	.0020 INCHES
SCALE =	.0100 SCALE		

RUN NO. 9/0 ROLL = 5.32 GRADIENT INTERVAL = -5. 5.00

ANL	ALPHA	BETA	CH	CA	CLN	CBL	CYN	CPB	CFC1	CFC2
5.331	-2.579	.00721	.33406	.03439	.04536	.00305	.00014	.3475	-.10840	-.11496
5.336	-11.271	.00663	.30383	.03777	.04357	.00379	.00036	.10510	-.11367	-.12149
5.346	-1.172	.00666	.24693	.03669	.04179	.00333	.00039	.20972	-.11993	-.12468
5.359	-6.914	.00754	.20134	.03939	.04016	.00356	.00051	.00613	-.12479	-.12339
5.354	2.364	.00731	.15155	.03696	.03897	.00333	.00055	.00612	-.12223	-.12852
5.361	3.598	.00916	.03746	.03746	.03652	.00306	.00049	.02168	-.12695	-.13323
5.351	4.199	.00902	.04096	.03517	.03512	.00295	.00046	.07627	-.12731	-.12861
5.347	6.373	.00922	.04633	.02754	.03163	.00281	.00041	.07687	-.14525	-.14495
5.359	6.556	.02940	.15155	.01495	.02901	.00290	.00040	.00697	-.15982	-.16431
5.345	10.921	.01244	.25268	.02108	.02643	.00231	.00044	.02897	-.16985	-.17126
5.336	13.756	.01370	.35497	.01770	.02216	.00216	.00047	.00151	-.01010	-.17755
5.342	15.282	.01153	.46447	.03234	.01694	.00382	.00113	.51046	-.16252	-.17953
5.331	17.497	.01376	.57953	.03101	.01276	.00407	.00121	.01250	-.18653	-.20107
5.341	19.656	.01620	.66101	.03045	.01561	.00358	.00076	.01396	-.19378	-.22763
5.337	21.793	.00979	.73557	.02964	.00031	.00170	.00161	.01144	-.18965	-.25052
5.328	25.975	.00870	.81249	.02526	.00713	.00145	.00184	.01160	-.22658	-.28182
5.322	26.322	.01746	.86992	.01484	.01256	.00272	.00246	.01201	-.27127	-.32325
GRADIENT	.00021	.04577	.00017	-.00156	-.00104	.00024	-.00295	-.00214	-.00214	-.00214

PARAMETRIC DATA

DATE 24 SEP 73

TABULATED SOURCE DATA. LARC LIFT-141

PAGE 5

LA-2511 TPT-1411 LARC LO-110 ORBITER (B1411)

(INPUTS) (17 AUG 73)

REFERENCE DATA

REF	49.9004 50.100	WIND	0.9101 INCHES
LNDP	15.5070 INCHES	YAWP	0.0000 INCHES
SWDP	10.5151 INCHES	ZWDP	0.0000 INCHES
SCALE	.0100 SCALE		

RUN NO. 775 RUN = 5.35 GRADIENT INTERVAL = -5.00/ 5.00

NUC	ALPHA	BETA	CH	CL	CLW	CLL	CM	CMW	CLW	CPB	CPD	CPG	CPH	CPJ	CPK	CPQ	CPG2	
5.350	-2.572	.00022	-.30003	.00045	.00027	.00167	-.00059	-.00060	-.00059	-.00064	-.00073	-.00073	-.00073	-.00073	-.00073	-.00073	-.00073	
5.352	-1.329	.00000	-.30000	.00000	.00000	.00000	-.00000	-.00000	-.00000	-.00000	-.00000	-.00000	-.00000	-.00000	-.00000	-.00000	-.00000	
5.356	-1.208	.00010	-.29110	.00006	.00006	.00006	-.00006	-.00006	-.00006	-.00006	-.00006	-.00006	-.00006	-.00006	-.00006	-.00006	-.00006	
5.360	.000	.00019	-.16007	.00077	-.00077	-.00077	-.00077	-.00077	-.00077	-.00077	-.00077	-.00077	-.00077	-.00077	-.00077	-.00077	-.00077	
5.370	.653	.00022	-.24187	.00433	.00433	.00433	-.00433	-.00433	-.00433	-.00433	-.00433	-.00433	-.00433	-.00433	-.00433	-.00433	-.00433	
5.371	1.956	.00017	-.19035	.00369	.00369	.00369	-.00369	-.00369	-.00369	-.00369	-.00369	-.00369	-.00369	-.00369	-.00369	-.00369	-.00369	
5.379	1.959	.00017	-.19035	.00369	.00369	.00369	-.00369	-.00369	-.00369	-.00369	-.00369	-.00369	-.00369	-.00369	-.00369	-.00369	-.00369	
5.375	3.056	.00026	-.14026	.00219	.00219	.00219	-.00219	-.00219	-.00219	-.00219	-.00219	-.00219	-.00219	-.00219	-.00219	-.00219	-.00219	
5.353	4.113	.00028	-.05028	.00095	.00095	.00095	-.00095	-.00095	-.00095	-.00095	-.00095	-.00095	-.00095	-.00095	-.00095	-.00095	-.00095	
5.355	6.355	.00019	.00096	.00196	.00196	.00196	-.00196	-.00196	-.00196	-.00196	-.00196	-.00196	-.00196	-.00196	-.00196	-.00196	-.00196	
5.356	6.370	.00023	.000973	.000932	.000932	.000932	-.000932	-.000932	-.000932	-.000932	-.000932	-.000932	-.000932	-.000932	-.000932	-.000932	-.000932	
5.361	10.773	.00047	.000937	.000937	.000937	.000937	-.000937	-.000937	-.000937	-.000937	-.000937	-.000937	-.000937	-.000937	-.000937	-.000937	-.000937	
5.365	12.943	.00076	.000937	.000937	.000937	.000937	-.000937	-.000937	-.000937	-.000937	-.000937	-.000937	-.000937	-.000937	-.000937	-.000937	-.000937	
5.351	15.156	.00072	.41551	-.00076	-.00076	-.00076	-.00076	-.00076	-.00076	-.00076	-.00076	-.00076	-.00076	-.00076	-.00076	-.00076	-.00076	
5.359	17.353	.00059	.50023	-.004366	-.004366	-.004366	-.004366	-.004366	-.004366	-.004366	-.004366	-.004366	-.004366	-.004366	-.004366	-.004366	-.004366	-.004366
5.357	21.724	.00032	.000783	-.000783	-.000783	-.000783	-.000783	-.000783	-.000783	-.000783	-.000783	-.000783	-.000783	-.000783	-.000783	-.000783	-.000783	
5.352	23.701	.00016	.000642	.000641	-.000641	-.000641	-.000641	-.000641	-.000641	-.000641	-.000641	-.000641	-.000641	-.000641	-.000641	-.000641	-.000641	
			GRADIENT	.00016	.00016	.00016	-.00016	-.00016	-.00016	-.00016	-.00016	-.00016	-.00016	-.00016	-.00016	-.00016	-.00016	

PARAMETRIC DATA

BETA	0.000	ALPHA	0.000	MACH	2.000
ELEVTR	-15.000	ATRDN	-0.000	WRFTR	.000
EFCLFL	-16.000				

LA-23 LTPT-141/LARC LC-100 ORBITER (DATA)

(17 AUG 73)

REFERENCE DATA

REF. = 49.9004 IN. IN. ZREF = 0.0150 INCHES
 LREF = 13.9000 INCHES YREF = .0000 INCHES
 BREF = 10.9191 INCHES ZREF = .0000 INCHES
 SCALE = .0100 SCALE

REFERENCE DATA

REF. = 49.9004 IN. IN. ZREF = 0.0150 INCHES
 LREF = 13.9000 INCHES YREF = .0000 INCHES
 BREF = 10.9191 INCHES ZREF = .0000 INCHES
 SCALE = .0100 SCALE

PARAMETRIC DATA

BETA = .0000 MACH = .169
 ELEVTR = -15.000 ALTTRN = .000
 BDFLAP = -10.000 RUGFLR = 201.000

REF. NO. 0/0 0/1 0/2 0/3 0/4 0/5 GRADIENT INTERVAL = -5.00/ 5.00

REF.	ALPHA	BETA	CH	CA	CLW	CDL	CTW	CTL	CPB	CPC1	CPC2
5.374	-2.467	.00004	-.38213	.03379	.03982	.00272	-.00159	-.00011	-.21092	-.16474	-.17487
5.377	-1.354	.00001	-.27197	.05619	.04169	.00274	-.00136	-.00015	-.23149	-.13480	-.19466
5.380	-1.160	.00002	-.21906	.05735	.03012	-.00221	-.00180	-.00127	-.22578	-.14226	-.19082
5.374	-0.853	.00003	-.17353	.05793	.03845	-.00256	-.00110	-.00192	-.22601	-.16964	-.19207
5.364	1.366	.00009	-.12179	.05774	.03692	-.00197	-.00297	-.00256	-.16755	-.20175	-.16962
5.355	2.155	.00030	-.07784	.05953	.03900	-.00184	-.00271	-.00273	-.23067	-.16657	-.219617
5.346	4.181	.00012	-.02913	.05293	.03421	-.00163	-.00264	-.00337	-.23234	-.15522	-.17469
5.336	6.972	.00026	.07867	.04515	.03131	-.00155	-.00251	-.00361	-.24716	-.16545	-.20113
5.326	8.802	.00078	.17185	.03192	.02931	-.00151	-.00227	-.00351	-.21769	-.16974	-.16971
5.310	10.810	.00003	.06634	.01492	.02672	-.00160	-.00221	-.00422	-.21391	-.15396	-.20233
5.304	12.992	.00171	.36638	-.10392	-.120	-.00125	-.0019	-.00314	-.21054	-.18895	-.22434
5.302	15.237	.00035	.49156	-.01954	-.01722	-.00125	-.00173	-.00629	-.19665	-.19612	-.25112
5.304	17.469	.00074	.60201	-.01927	-.01216	-.00125	-.00168	-.00762	-.21113	-.20963	-.31272
5.300	19.684	.00169	.69756	-.01435	-.00692	-.00143	-.00105	-.01105	-.20198	-.28272	-.31067
5.294	21.799	.00076	.70424	-.01446	-.00764	-.00161	-.00169	-.00946	-.26471	-.33217	-.33266
5.309	23.995	.00064	.67143	-.01531	-.00673	-.00122	-.00235	-.01177	-.36861	-.29443	-.34993
5.300	30.010	.00116	.04516	-.02017	-.00146	-.00105	-.00104	-.00152	-.01143	-.01131	-.01257

REF.

REFERENCE DATA

SCD =	09.0000 50.1IN.	THRP =	0.9100 INCHES
UNP =	13.3000 INCHES	THRP =	0.9000 INCHES
END =	10.9111 INCHES	THRP =	0.9000 INCHES
SCALE =	25.00 SCALE		

RUN NO. 100 0 0001 = 5.36 GRADIENT INTERVAL = -5.00V 5.00

PARAMETRIC DATA

BETA =	.000	MACH =	.168
SLCUT =	.000	ALBOM =	.200
SLCPA =	-10.000	SLCPA =	20.000

DATE 24 SEP 73

TABULATED SOURCE DATA, LARC LTP1 141

PAGE 10

LA-23 (LTP1-141) LARC LO-100 ORBITER (BM) VFS

REFERENCE DATA

SPDF = 49.3624 50.1IN. XHFP = 8.9100 INCHES
 LREF = 13.5320 INCHES YHFP = .9300 INCHES
 BREF = 10.5151 INCHES ZHFP = .9300 INCHES
 SCALE = .0100 SCALE

RUN NO. 13/0 RAVL = 5.47 GRADIENT INTERVAL = -5.00/ 5.00

RNL	ALPHA	BETA	CA	CLH	CBL	CYN	CY	CPB	CPC1	CPC2
5.359	-2.249	.029227	-.19409	.10878	.02696	-.030223	-.00251	.02259	-.51015	-.32321
5.353	-1.129	.029393	-.13912	.11098	.02570	-.03019	-.00243	.02216	-.45661	-.30773
5.407	-1.069	.010935	-.09344	.11092	.02343	-.03016	-.00246	.02205	-.50253	-.33934
5.371	1.134	.029333	-.04333	.11196	.02219	-.02703	-.00245	.02221	-.51070	-.31269
5.369	2.251	.029223	-.02780	.11079	.02119	-.02702	-.00246	.02256	-.51863	-.32292
5.417	3.392	.029381	.05139	.10866	.02326	-.02592	-.00247	.02226	-.47945	-.25673
5.363	4.393	.010350	-.01036	.10663	.01885	-.02052	-.00256	.02213	-.51334	-.33579
5.349	6.955	.029393	.19334	.09731	.01612	-.02748	-.00254	.02228	-.48426	-.31368
5.332	8.832	.010001	.29871	.08361	.01271	-.02706	-.00276	.02282	-.44806	-.36796
5.366	11.054	.029371	.38937	.16324	.02871	-.02697	-.00269	.02287	-.42318	-.36674
5.419	13.253	.029319	.503561	.04363	.00524	-.02663	-.00181	.02034	-.37183	-.40191
5.366	15.443	.029476	.61349	.03174	-.00158	-.02774	-.00267	.02262	-.38949	-.41618
5.416	17.674	.027950	.72461	.03159	-.00381	-.00375	.00139	-.02936	-.36236	-.35718
5.379	19.807	.029379	.80155	.03422	-.00543	-.00357	.00298	-.02930	-.58017	-.42917
5.447	22.327	.029399	.89645	.03261	-.01052	-.00223	.00167	-.00836	.69163	-.48901
5.467	24.307	.01405	1.02094	.02743	-.01565	-.00459	-.00016	-.00181	-.79324	-.53431
GRADIENT	.02709	.04393	-.07734	-.00117	-.07706	-.00201	-.00202	-.01169	-.01421	-.01195

PARAMETRIC DATA

	BETA = .000	MACH = .157
ELEVTR = .700	AILRON = .200	
BDFLAP = -10.000	RUDFLR = .00.000	

(RP010) (17 AUG 73)

DATE 24 SEP 73

TABULATED SOURCE DATA, LARC LTPT 141

PAGE 11

LA-23 (LTPT-141) LARC LO-1RD ORBITER (647 VFB)

(RPD11) (2N SEP 73)

REFERENCE DATA

SREF	=	49.9624 SQ. IN.	XHYP	=	8.9100 INCHES
LREF	=	13.5070 INCHES	YHYP	=	.0000 INCHES
SREF	=	10.5151 INCHES	ZHYP	=	.0000 INCHES
SCALE	=	.0100 SCALE			

RUN NO. 14/ 13 RNAL = 4.86 GRADIENT INTERVAL = -5.00/ 5.00

RNAL	ALPHA	BETA	CN	CA	CLH	CLL	CYN	CY	CFB	CFC	CPC1	CPC2
4.679	-2.190	5.10386	.07347	.01200	-.02176	-.00293	.00672	-.08592	-.05271	-.16218	-.05346	
4.852	.138	5.10705	.02859	.01336	-.00338	-.00474	.00698	-.08706	-.05798	-.06749	-.06613	
4.679	2.129	5.10771	.07035	.01411	-.00527	-.00546	.00702	-.08715	-.05562	-.06377	-.05816	
4.865	2.299	5.10638	.12297	.01163	-.00627	-.00652	.00704	-.08682	-.06942	-.06277	-.05948	
4.676	3.345	5.10385	.16630	.01923	-.00778	-.00796	.00713	-.08680	-.06312	-.06853	-.06211	
4.865	4.493	5.09826	.21559	.03620	-.00888	-.00754	.00730	-.08684	-.06764	-.06603	-.05969	
4.846	6.658	5.08182	.31463	.03472	-.01143	-.00877	.00748	-.08958	-.06808	-.06276	-.06922	
4.827	8.974	5.05946	.41528	.01918	-.01451	-.01011	.00779	-.09086	-.07281	-.07253	-.07536	
4.865	11.232	5.03253	.52427	.03746	-.01830	-.01173	.00737	-.08985	-.07735	-.08205	-.08211	
4.867	13.441	5.01344	.63867	.05115	-.02392	-.01167	.00480	-.08437	-.08152	-.08156	-.07999	
4.919	15.750	4.96390	.79337	.05525	-.02739	-.01219	.00395	-.08137	-.11193	-.11121	-.10538	
4.926	17.678	4.31991	.81525	.05154	-.02716	-.01090	.00605	-.11428	-.14428	-.13556	-.12782	
4.892	19.901	4.86697	.83572	.03666	-.02725	-.00608	.00807	-.09552	-.21039	-.19252	-.18827	
4.860	22.030	4.81154	.94581	.03712	-.03221	-.003818	.00725	-.19528	-.24761	-.22283	-.21512	
	GRADIENT	- .002072	.04321	-.00196	-.00106	-.001171	.00278	-.00146	-.00186	-.00179	-.00168	

PARAMETRIC DATA

BETA =

5.000

MACH =

.104

ELEVTR =

.000

AILRDN =

.000

RUFFLR =

.000

DATE 24 SEP 73

TABULATED SOURCE DATA, LARC LTPT 141

PAGE 12

LA-23 (LTPT-141) LARC LO-100 ORBITER (MNRFB)

(RPUD12) (20 SEP 73)

REFERENCE DATA

SPDF	=	49.9624 58.1IN.	ZHDFP	=	0.9100 INCHES
UHDF	=	13.3000 INCHES	YHDFP	=	.0000 INCHES
BHDF	=	10.5131 INCHES	ZHDFP	=	.0000 INCHES
SCALE	=	.0100 SCALE			

PARAMETRIC DATA

SPDF	=	2714
ELEVTR	=	5.000
EDFLAP	=	0.000
		MACH
		1.010
		ATLFRN
		20.000
		RUFFLR

RUN NO. 15/0 INV/L = 4.44 GRADIENT INTERVAL = -5.00/ 5.00

ALPHA	BETA	CH	CLH	CLW	CN	CN	CY	CPD	CPC1	CPC2	
4.420	-2.211	5.10382	-.11216	.59031	.00163	.00001	-.09524	-.26277	-.29534	-.23692	
4.413	-1.003	5.10313	-.00060	.59168	.00226	.00033	-.04875	-.24772	-.26226	-.22206	
4.406	-.008	5.10761	-.01362	.59162	.00296	.00031	.00010	-.23754	-.30262	-.22699	
4.403	1.125	5.10565	.05891	.59227	.00211	.000405	.00013	-.25091	-.2695	-.21961	
4.395	2.173	5.10371	.07917	.59053	.00066	-.00477	.00184	-.097449	-.25506	-.26254	
4.392	3.317	5.09970	.18786	.54858	-.00263	.000532	.00080	-.092063	-.26928	-.30401	
4.390	4.311	5.09544	.17976	.54435	.00162	-.00793	.00086	-.09187	-.22894	-.23082	
4.437	6.756	5.06253	.26346	.53311	.00458	-.00716	.00090	-.09463	-.28397	-.21671	
4.400	8.949	5.03617	.37253	.52708	-.00747	.00623	-.00941	-.09511	-.35341	-.23584	
4.435	11.529	5.03484	.48148	.50469	-.01115	-.00917	.00915	-.09522	-.36417	-.28421	
4.370	13.291	5.00013	.60181	.51054	-.01696	-.00938	.03680	-.36991	-.29374	-.24740	
4.408	15.325	4.98049	.69765	.51308	-.02026	-.01060	.00594	-.08611	-.37250	-.28913	
4.409	17.062	4.91077	.77798	.51133	-.02274	-.00998	.00719	-.08786	-.41029	-.30185	
4.420	19.303	4.85055	.86669	.50739	-.02254	-.01062	.01081	-.09049	-.45543	-.35222	
4.367	22.516	4.85247	.94353	.50573	-.02638	-.00988	.00714	-.09126	-.52169	-.37152	
4.439	24.162	4.75103	1.03047	.50311	-.03136	-.00803	.01465	-.08829	-.52941	-.38739	
	GRADIENT		-.33116	.04316	-.00114	-.00066	.07007	-.00029	.00137	-.00327	.00293